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OUTDOOR INDUSTRIAL ILLUMINATION

THE adequate illumination of areas devoted to industrial activity has been and is to be in the future an important part of the great contribution of electricity to the progress of Western development. The necessities of the war and particularly the phenomenal growth of the shipbuilding industry of this coast taught many lessons in the practical value of proper lighting which are finding more and more extended application in peace times. The yard of the Southwestern Shipbuilding Company at East San Pedro, Cal., presents a notable example of illumination of outdoor spaces where active construction and assembly work is conducted even at night with high efficiency and without risk of personal injuries.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST
AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45 | SAN FRANCISCO, JULY 15, 1920 | Number 2

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LET THERE BE A LITTLE MORE LIGHT

BEFORE Adam's birthday the statement was made, "Let there be light." And, of course, there was. At least there was a certain amount, plenty to supply the primitive needs of the day. Work and play were during the daylight hours and there were no books to read at night. Later with more complicated, if not more enjoyable, living there was a growing need for more illumination. And, ever since, there has been the cry, "More light."

To trace the progress in illumination from the ages well named the "Dark Ages," to this, would be to follow the history of civilization itself. It is sufficient to say that every step in better lighting was a step of progress; either the better lighting caused the progress or progress demanded better illumination. It now appears that these two things are concurrent. Increased illumination of the home, the factory and the office makes for better, more efficient work, and better work demands more light. Realizing this, every aid should be rendered to further the efforts of those engineers who have assumed the burden of stimulating the use of increased illumination.

Inductive Interference

The outstanding feature of a discussion on inductive interference at the recent Pasadena Convention of the National Electric Light Association hinged about the point of public policy. Increasing voltages and instances in transmission of hydroelectric energy combined with the present state of flux in telephone evolution make the situation in connection with inductive interference more acute every day. Little evidence of a development of broad and intelligent policies on the part of power companies is to be seen in the nation today. On the other hand, the telephone company has instituted a clean-cut, definite policy which governs its actions throughout the nation.

It was, then, with great enthusiasm that the industry, through its representatives at the Pasadena Convention, listened to the remarks of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, when he arraigned the power executives of the nation for not having instituted in the past more definite policies looking toward a successful and complete solution of the inductive interference between telephone and power lines. We hear much nowadays of the industry looking toward a closer cooperative action between merchandisers of electrical ware. Insofar as physical investigation and scientific research are concerned, perhaps no other instance stands out in the industry today more susceptible of cooperative treatment than that of inductive interference investigation. It is a problem in which the telephone company as well as the power company is concerned, and, in the advent of more extended railway electrification of steam railroads, a problem into which the railroads would also be ultimately drawn with no uncertain calling of responsibility. It is, as a consequence, with no little emphasis that the Journal of Electricity would urge upon the industry, and particularly upon central stations, that this problem be given more emphasis in the near future. With the advent of vast interconnections of service, inductive interference will ever be with us, and, as a consequence, we must keep ahead of this problem or else unforeseen difficulties may arise which might prove extensive and embarrassing, and which may be avoided as the result of intelligent forethought.

Automatic Sub-Stations

It is possible only through a general survey of the entire field readily to grasp the rapid strides which are being made in the application of automatic apparatus in the generation, transmission and distribution of electric energy, particularly automatic sub-station installation.

The economies to be derived from automatic operation of sub-stations for the transformation and distribution of electric power for miscellaneous applications are now quite generally understood, and the apparatus for this purpose has reached a comparatively high state of development, although further simplification in details is highly desirable.

The application of automatic sub-stations to railway operation is of great significance in the West, as in some instances the economic margin between electrification of steam railroads or double tracking is so narrow that the cost of operating the sub-stations necessary for the electrification, together with the line losses in the low tension distribution, may be the determining factor in the case. An eminent authority on this subject has pointed out that the successful operation of automatic sub-stations

for this purpose has entirely changed the whole situation, since the automatic stations have such a decided advantage in operating costs, and the substations may be placed so much closer together that the low tension losses are also materially reduced. With this point in view it is of the utmost importance to the industry in the West to see that automatic apparatus is given the greatest encouragement possible.

National Society of Engineering Profession

The more or less isolated position of the engineering fraternity in the West, due to the great distances involved and the individual character of the problems which have developed in consequence and which are common to the district, has fostered the growth of local engineering centers in which engineers of all branches have joined together to meet common issues. The recent federation of national engineering and allied societies, plans for which were definitely made at the conference held at Washington, is therefore wholly in the spirit of western development.

The particular form and details of constitution of such an inter-organization are always open to individual comment, but the broad-minded attitude of give-and-take manifested by the parent societies at this joint meeting has started a nucleus of cooperation which is a safe basis for further development. The stand taken by the meeting that such a joint body shall represent the societies involved as units and not be a new organization formed from the individuals of all the groups, leaves the present associations without loss of the powers they now enjoy, in a position to cooperate in all matters of common interest.

The further development of this joint body which unites engineers, chemists, architects—in fact all professional men working toward the same end—is now in the hands of the individual organizations which shall uphold or disapprove the action of their delegates. The mere opportunity of working together, of standing together on public questions and of advertising professional men together in the mind of the public should be sufficient reason for neglecting any petty differences of opinion as to method and getting together on the reasonable basis now offered.

Forwarding Better Lighting

It is difficult to conceive of the rapid progress in lighting units and applications within the past few years. Almost immediately after one lighting unit is put into use another is developed and ready for the market, and it has been through only the most intensive education of the public that the demand for the improved units has been maintained. To maintain this demand, and to educate the public in the use of better illumination has been the function of the illumination engineers of the country. The scientific application of their art is most modern, while the art itself is most ancient.

As the principal tenets of the Illuminating Engineering Society are to conserve human vision, increase human efficiency and promote beauty, it is gratifying to note that the few dozen members of this society on the Pacific Coast are to form a branch in San Francisco in order that they may cooperate in the good work of forwarding these principles underlying better lighting, not only in the factory and the industrial plant but also in the shops and the homes. The Journal of Electricity wishes them the greatest success.

Lighting the Home

Fifteen thousand people visited the San Francisco Electrical Home during the two weeks immediately following its opening to the public. This means that fifteen thousand minds have changed their conception of what the words "electrical home" mean. Among other things, they have been impressed with the fact that the modern home must be equipped with thirty convenience outlets rather than with four or five, but they have been even more strongly impressed with the fact that beautiful and correct lighting stands out as more important than all other factors of interior decoration.

Up to this time the majority of home makers have not realized that the lights of their home go a long way toward determining their state of mind while within its walls. The average Western home is well lighted, to be sure, but men of the electrical industry are looking to more than this. Through such mediums as the above mentioned electrical home and others of its kind which are being planned in a number of California cities, the public is being shown that home lighting should be nothing less than excellent.

Through these model homes men of the electrical industry are demonstrating how the use of properly designed fixtures and appropriately colored lights can do more than any other feature to carry out the decorative scheme of a room. And further than that, they are demonstrating the fact that the right lamp in the right place can add immeasurably to the beauty of any room and even more to the comfort and convenience of the entire home. After seeing the harmony and beauty which are brought about in the specially planned electrical home, one cannot but realize the great service which will be rendered to the public and the increased profit which will come to the men of the electrical industry through the intelligent and unending cooperation of the electrical contractor, the architect and the home builder for the purpose of making the Western home the acme of beautiful interior illumination.

A Solution of the Contractor's Problem

The wiring plan for a house or factory drawn up by the average architect can usually be interpreted in as many ways as there are contractors bidding on the job. This lack of clearness must be considered largely responsible for the great difference in the bids submitted by the contractors, according to the statement made by

Romaine Myers, consulting engineer of Oakland, at the recent convention of the California State Association of Electrical Contractors and Dealers at San Jose. In cases where the wiring plan had been laid out by a competent engineer, Mr. Myers said, there is usually only five per cent difference between the high and low bids for that job.

It has been suggested by one of the contractors that a committee of contractors be appointed to meet with the electrical and mechanical engineers to try and find some means whereby all wiring plans will be laid out by competent engineers. If this plan can be carried out it will mean a saving in the cost of electrical installations because every contractor will know exactly what is to go into the job and can bid intelligently. With the present plans the contractor, to protect himself, must add a larger profit to cover the risk of being called upon to install something that was not clearly shown on the plan. Another advantage of this plan would be that adequate lighting would be assured to the customer, that there would be sufficient convenience outlets, and that the customer would know before the work was started exactly what it would cost, for there would be no excuse for extras, and exactly what the job would look like when it was finished.

The plan deserves careful consideration and should receive the attention not only of the engineers but of the contractors all over the country as a remedy for the differences in submitted bids which are misleading to the customer and harmful to the industry.

The New Accident Law

Now that industrial lighting and industrial installations of various sorts are being so actively discussed throughout the West, it behooves every member of the electrical industry to give serious thought to the question of new legislation along accident and industrial lines. Every commonwealth of the West is vitally interested in this subject, particularly California. A year and a half ago a bill which was designed to give broadened authority to the California Industrial Accident Commission was defeated in the California State Legislature. Every one believed in the general principles of the law, but there were many features that seemed undesirable, and, as a consequence, such leagues as the San Francisco Electrical Development League and the Los Angeles Electrical League aroused public sentiment so thoroughly that the bill was defeated. Nevertheless in the main, new legislation is desirable.

It is time, then, to undertake broad discussion of such problems as this. Institutions such as Development Leagues in various communities of the West should appoint committees to investigate these subjects, and see that the legislation has the backing of the electrical industry in every instance where constructive legislation is asked. There is a need for legislation in California, particularly with reference to inspection of pumping plants and suburban installations, and also with regard to the local inspectors having to pass state examinations. This is no time to allow any selfish interests to thwart the passage of necessary legislation. Let the industry give prompt and broad consideration to this vital subject of the hour.

The Return of the Electric Vehicle

Even the casual observer must come to the conclusion that the pleasure car operated with gasoline is today in a critical situation. To thoughtful men of the electrical industry a new and pleasing vision comes to mind, namely, that the electrically propelled vehicle will again come into its own when developed to take the place of the gas operated car. So large and so vast are becoming the uses of gasoline in needed lines of national industrial development, that the thinking mind must come to the conclusion that sooner or later the pleasure car operated by gasoline must pass out of use. Inventors and those interested in research activities should give increased attention to the further development of the electrically propelled pleasure car, for now indeed it can render a real service to the country and furthermore there is all reason to believe that the present demand for this type of car will be permanent.

Illumination Outdoors

Practical results of a large outdoor lighting scheme such as those presented in this issue fill a real need. Many industries conduct their operations in the open or in such large interior areas that they come within the general character of the one described by Humphrey and Taplin and the specific kinds of apparatus found to give satisfactory results at San Pedro should be not only of value to illumination engineers but also to engineers who construct those projects which demand night work.

Of particular importance are the intensities used in this installation. One and a half foot-candles in those places where material is stored, and four and a half foot-candles where active work is performed have given good results in the production rates. Furthermore, no accidents have resulted due to insufficient light. This is one of the factors of prime importance and a cause of congratulation to the designers.

Industrial Lighting and the Contractor

The need of proper lighting in industrial plants is now recognized by the majority of plant managers who are in the proper frame of mind right now to make any changes in lighting that will increase their production, cut down their spoilage and help to retard the number of accidents, which are always costly. With its large number of manufacturing plants which have heretofore received but little attention, the Pacific Coast is now ready to accept the latest improvements in industrial lighting.

The market is here, the customer ready and willing to be convinced and buy, and it only remains for the contractor to take advantage of this ready mar-

ket. The market is here but the prospective customer has been educated by extensive publicity and will expect the contractor that comes after his business to be well posted on all of the latest ideas, and the contractor that can make the best selling talk will get the contract.

The contractor should go after this business but he should go well prepared with facts and figures, and he should not lose sight of the fact that he is a missionary of better lighting and as such he is helping to increase production, reduce waste and is insuring better working conditions for his fellow man.

The Motion Picture for the Power Company

Motion pictures have for some time been used as an effective advertising medium both by manufacturers and by such organizations as are devoted to the welfare of the entire industry. They are routed on the regular schedule of the theaters in the smaller towns and are much in demand by schools and organizations. Until recently, however, the idea has not been applied to the needs of the power company, except as all branches of the electrical industry are benefited by an increase of public good will toward any one of them. The motion picture "That Fairy in the Snowflake" which was a feature of the Pasadena convention was perhaps the first achievement along this line and is to go out to the public carrying with it an understanding of the fundamental principles which underlie the production of electricity, as well as some of the romance and dignity which underlie the industry. In a region which is to ask for $700,000,000 for further electrical development within the next ten years, the value of this familiarity with processes on the part of the public is obvious.

A slightly different angle of approach has been followed by another western company which has made several thousand feet of reel covering the more personal side of the company's activities. The practice of "customer ownership" which originated in the West and which has perhaps found its widest application here, has already established friendly relations between power companies and the communities they serve. Such popular pictures as those now undertaken are destined to better this understanding into a real friendship which will prove invaluable as a basis for development and service.

The Electric West

The thoughts brought out so forcibly at the wonderful convention at Pasadena by the various reports of the National Electric Light Association committees cannot be too often recalled. The outstanding feature of the discussions was, of course, that the West is yet young in the electrical matters although it already leads the nation in the utilization of electrical devices and it has greater undeveloped possibilities for the economical generation of electrical energy than any other section of the country, or indeed for the whole of the other parts combined.

It follows that there would be no reason for considering these subjects unless the electrical energy had a useful application. A gigantic waterfall in a remote part of Africa, while of interest from a purely theoretical viewpoint, is not a thing that is often discussed by practical people; undeveloped coal mines in the interior of Siberia are not of general interest, but the hydroelectric possibilities of the West are neither remote from civilization nor in an undeveloped country. They are in the heart of one of the most productive sections of the world. Minerals are near at hand, rich land is waiting the hand of the agriculturist and here are ports through which the Far Eastern trade must pass, and, with these resources waiting, almost impatiently, the power now wasting will never need to hunt for a market.

It only requires a short trip through the various sections of the West to realize that the term "electrical West" is soundly given. Electrical power is the foremost force behind the tremendous development under way. In all parts the activity in all lines is impressive; new buildings are being constructed, many of them having only waited the development of electric power, and new farms are being plowed, certainly most of them having awaited the vitalizing force of electric power.

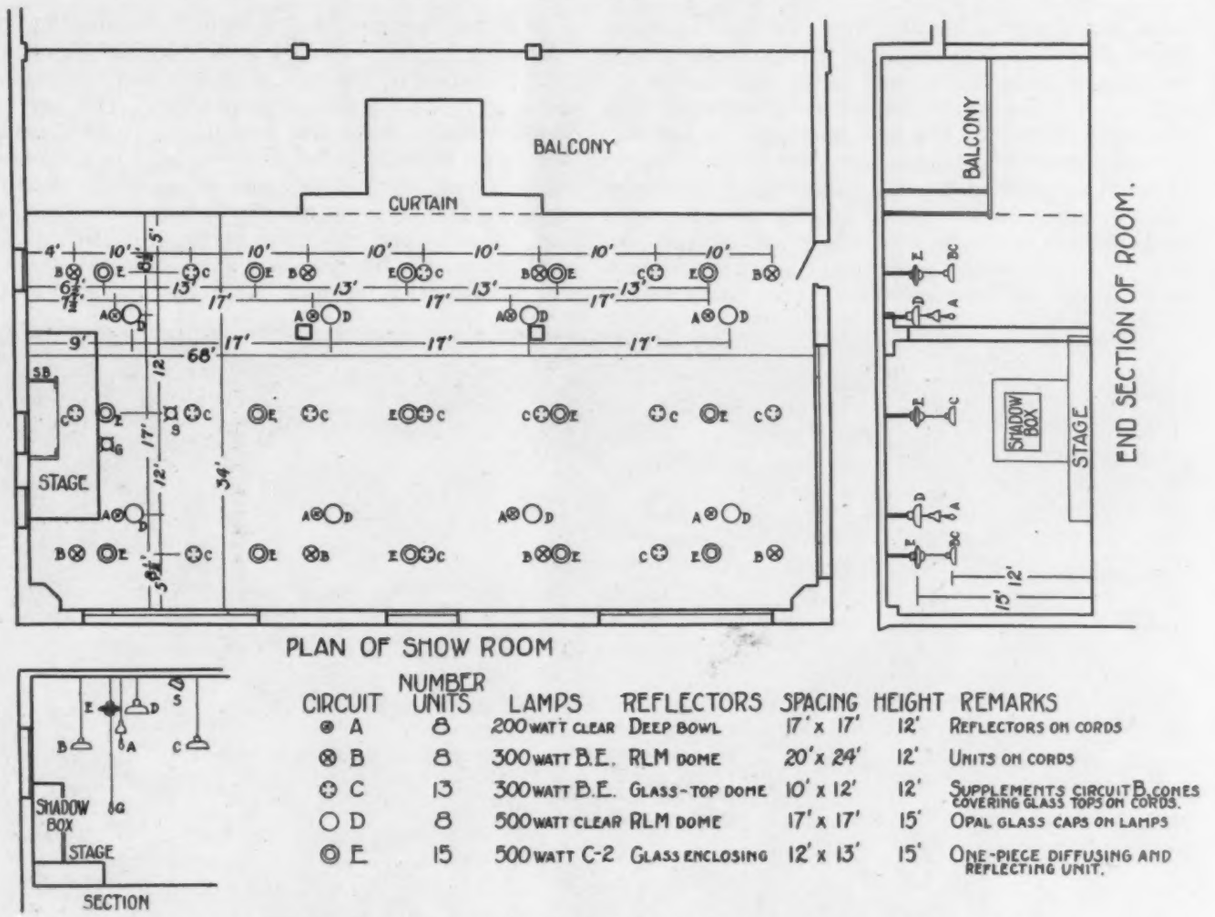
This is the electrical day of the West. And the message is going throughout the land with the result that the upward curve of development will incline ever higher.

The Demand for Technical Men

is growing so rapidly that making engineers has come to be one of the most important functions of an American university

The Student—The Professor—The Executive

will severally present their views on technical education in the August 1st issue of the Journal of Electricity



CIRCUIT	NUMBER UNITS	LAMPS	REFLECTORS	SPACING	HEIGHT	REMARKS
⊙ A	8	200 WATT CLEAR	DEEP BOWL	17' x 17'	12'	REFLECTORS ON CORDS
⊗ B	8	300 WATT B.E.	RLM DOME	20' x 24'	12'	UNITS ON CORDS
⊕ C	13	300 WATT B.E.	GLASS-TOP DOME	10' x 12'	12'	SUPPLEMENTS CIRCUIT B. COMES COVERING GLASS TOPS ON CORDS.
○ D	8	500 WATT CLEAR	RLM DOME	17' x 17'	15'	OPAL GLASS CAPS ON LAMPS
◎ E	15	500 WATT C-2	GLASS ENCLOSING	12' x 13'	15'	ONE-PIECE DIFFUSING AND REFLECTING UNIT.

Fig. 1.—Plan and elevation of Demonstration Room showing lighting layout and type of units employed.

Seeing Is Believing

BY L. C. KENT

(Visual instruction is unusually pertinent when appertaining to illumination. No better way of showing the effects of better lighting can be followed than actually to show by demonstration the difference between good and poor illumination. The following article which treats of this subject is by a member of the Engineering Department of the National Lamp Works at Nela Park.—The Editor.)

"Seeing Is Believing" was the terse but comprehensive title of an industrial lighting demonstration staged under the auspices of the Lighting Sales Bureau of the N. E. L. A. at the recent convention in Pasadena.* The purpose of the demonstration was to show first of all to the Central Station executives what modern lighting has to offer in the way of rendering greater service to the consumer and of building the lighting load of the Central Station, and to show, further, the part a well worked out demonstration performs in carrying the message of lighting to the user of light. To say that the demonstration accomplished these objects is simply putting it mildly without any attempt to portray the enthusiasm which was manifested by those in attendance.

The past year fairly well marks the turning point in the lighting industry. Old standards of illumination practice have passed into the discard and in their place have come new and higher standards, better equipment and application, all founded on the knowledge that illumination is something more than a hit-or-miss arrangement of light sources, that light is something which can be measured, controlled and directed efficiently down on the working area where the effect on the user of light should begin. By virtue of exhaustive tests in a number of industrial plants under actual working conditions, it has been demonstrated that the industrial illumination problem is one which vitally affects the earnings of a plant. By the use of proper and adequate illumination, production has increased—spoilage lessened and general all-around betterment of working conditions has resulted.

Technical societies and trade papers throughout the country have elaborated on the subject of "better" lighting. They have spread the doctrine of good lighting among thousands in industrial and commercial fields and have achieved as a result an awakened and widespread interest in illumination which has

* The booklet "Seeing Is Believing" issued by the Commercial Section, Division on Industrial Lighting of the Lighting Sales Bureau, offers the cooperation of the Bureau in working out and arranging a satisfactory demonstration under any specific local conditions.

been characterized as the New Era in Lighting. In dealing with intangible and impalpable things such as lighting is—or used to be—description and discussion alone cannot convey a full understanding and appreciation of the new standards in lighting. Its attributes and potentialities must be made known through demonstration. Good lighting must be seen, felt and experienced; it should be contrasted directly with conditions of the kind which still prevail generally. In this way, the Central Station representative realizes the truly enormous opportunity he has to serve the industry, while at the same time multiplying several times the revenue from this load. By this means, also, the associated electrical interests of a given community can acquire the common understanding of the subject necessary to undertake a program through which the consumer will be adequately served with equipments of the proper kind, properly installed, and thus remove the limitations on the amount of light which the factory can profitably employ. And, finally, a demonstration forms, by all odds, the most effective sales method. It offers the opportunity of arousing the interest and of educating not only officials of individual plants, but also entire engineering, trade and business organizations.

Ward Harrison, well known in illuminating engineering circles, spoke at each meeting giving his interpretation of the considerations and various aspects of modern illumination practice. The lighting demonstration which was held in the Show Room of the Hotel Huntington Annex consisted of a number of different lighting systems on separate circuits, showing various types of reflectors at different spacing distances and mounting heights. With this arrangement, Mr. Harrison had at his disposal systems of various merit ranging from the poorest to the ideal, which could be switched on and synchronized, as it were, with his talk, thus driving home all of the salient features of illuminating engineering practice.

Fig. 2.—General view of the Demonstration Room

Figure 1 shows a plan and elevation of the demonstration room, showing locations of the outlets together with the fixtures on each circuit. Fig. 2 is an interior view of the room with the various systems turned on. On the tables at which the audience sat were placed foot-candle meters for measuring the illumination, bright tinned pans and lids for observing reflected images of light sources, and castings of such complication as to indicate the shadow conditions. In this way they were able to compare the various systems and types of lighting units, to see

for themselves that glare and reflected glare are something more than technicalities and that they should be eliminated, to observe that correct spacing units insures uniformity of illumination, to learn something of color quality and light direction, and finally, that the phrase "too much light" has its origin in "too much glare."

Figure 3 shows a close-up view of the stage. A small platform was erected across the front of the room and the control of all lighting units brought to a switchboard at this point. A rheostat in the main circuit permitted a reduction of voltage of the various systems to a large range below normal. At the back of the platform was a long box lined with cloth and open at the front, in which were three vertical wooden bars of different cross sections, and lighting circuits providing illumination from any or all directions. A screen for the projection of lantern slides was placed above this box.

Above and to the front of the stage was mounted a 200-watt floodlight with its beam directed on the stage. A rheostat was placed in series with this lamp so that the intensity of illumination on the stage could be varied at will.

A large card in the form of a Snellen Chart, so modified as to reduce the gradation in size between rows of letters, stood on a table. In addition there was provided a shutter-like device for "instantaneously" exposing a desired letter or group of letters to view.

At one side of the stage was a row of lamps with clear bulbs, diffusing bulbs, diffusing globes, etc., for use in analyzing glare. Near this was placed a chart with lettering of various sizes and near the bottom a circular opening behind which was placed a 300-watt all-frosted lamp connected with a rheostat.

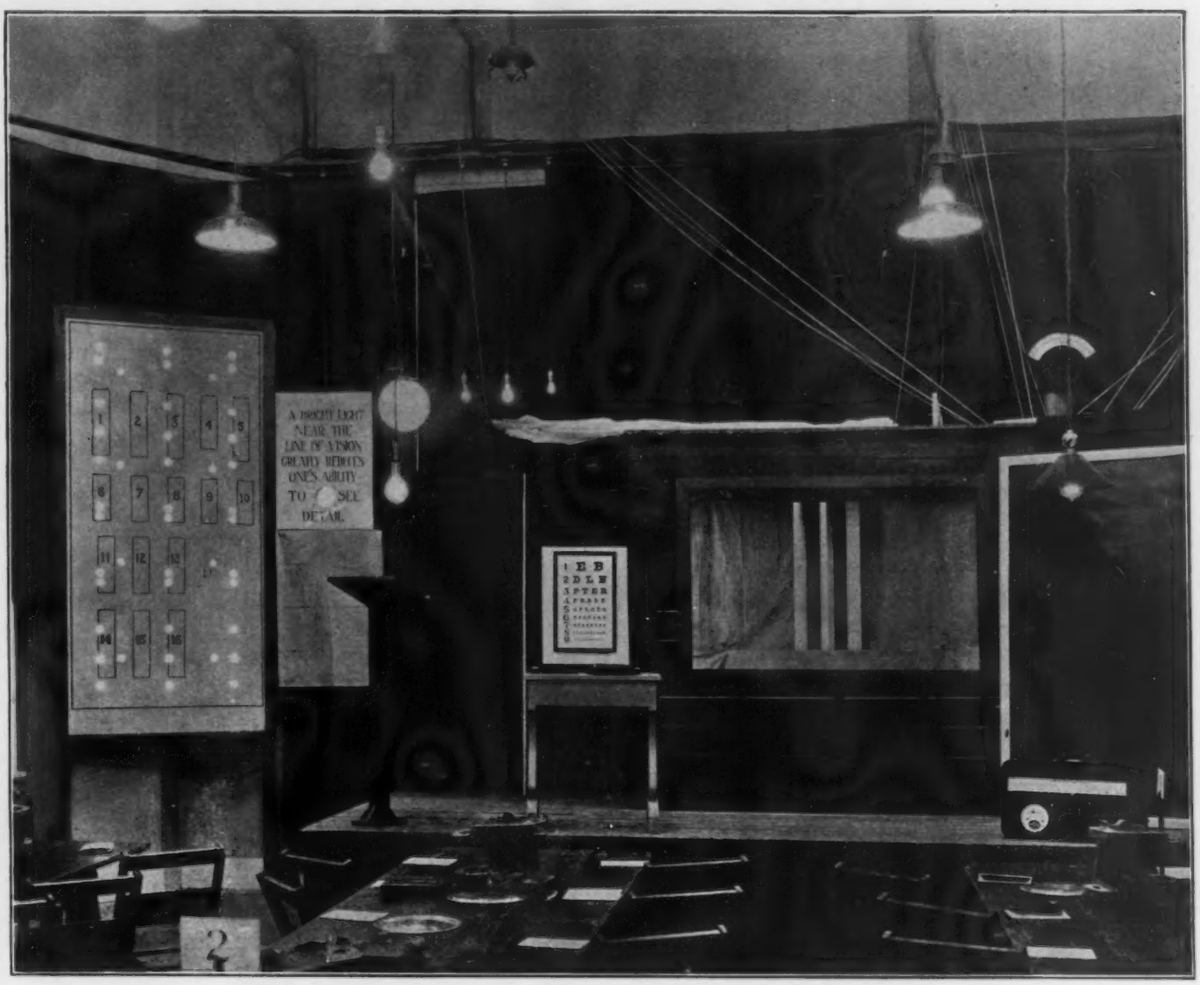


Fig. 3.—View of stage showing apparatus in illustrating the various illumination principles.

A large chart showing a plan view of the room with the different systems of lighting and indicating the position of the various tables was available in discussing the results obtained. A blackboard completed the platform equipment. With the above mentioned equpiment at hand, the speaker had facilities for outlining to his audience the steps in illumination design, illustrating the conditions to be avoided as well as pointing out the essentials of every good illumination system.

Taking up first the elementary considerations in the design of a lighting system for the demonstrating room, Mr. Harrison turned on a system of bare lamps, but due to the large amount of lighting strik-

ing the walls and ceiling, the intensity as read by the foot-candle meters on the tables was far short of that which he set out to get. Reflectors were then lowered over the lamps and the intensity again read. With the reflectors, greatly increased foot-candle values were obtained. Glare from unshaded light sources was illustrated by the bare lamps, contrasted with the results when the reflectors were lowered over the lamps.

Non-uniformity resulting from too wide spacing of units for a given mounting height was indicated by a system, otherwise very good, but where the illumination directly under the units was found to be five or six times that midway between lamps. Substantially uniform illumination was obtained by the same number of units mounted higher. At the lower mounting height, however, with a closer spacing of units, uniform illumination was obtained.

The superiority of dome reflectors over deep bowl reflectors in illuminating vertical surfaces as well as softening shadows was observed by viewing the castings on the tables when each system was turned on.

The general impression produced by different types of lighting installations was noted in comparing the dark ceilings and walls characteristic with deep bowl reflectors, the better illumination of side walls with dome reflectors, the improved illumination of ceiling as well as walls with glass top dome reflectors, and the attractive appearance of ceilings, walls and the units themselves, when the glass enclosing units were employed.

Illumination calculations always take into account the color of walls and ceilings, and, to demonstrate the significance of this factor, the walls of one-half of the room were draped with dark cloth having a refraction factor of about 15% while the other half was covered with light colored cloth which reflected approximately 60% of the light. The foot-candle meter readings in that part of the room surrounded by dark walls were noticeably lower than in the part where the walls reflected the greater part of the light.

That color quality of light has a great deal to do with the effectiveness of a lighting system was demonstrated by one system using daylight lamps. Not only was color identity and identification of objects with the whiter light more marked, but also the light mixed well with daylight, as was clearly observed when the curtains were drawn from the windows.

The effect of undervoltage burning of lamps was clearly demonstrated by noting the foot-candle meter readings when the lamps were burning at full voltage and when the voltage was reduced.

As a fitting climax to the general lighting demonstration, all the systems were turned on simultaneously, flooding the room with light giving an intensity of over 70 foot-candles, revealing all details of objects perfectly with entire comfort to the audience. The popular fallacy of "too much light" was shown to result from the use of units which cause glare.

Much has been written on the value of good lighting and higher intensities in increasing production, reducing accidents, etc., but as the eye apparently functions well over such an enormous range of intensities, it is hard to conceive just how these things come about. Mr. Harrison showed in a convincing manner that visual acuity is dependent upon light intensity and also that there is such a thing as the time element in vision. The modified Snellen Chart was first illuminated to an intensity of the order of 1½ to 2 foot-candles, and then to 12 to 15 foot-candles. Under the latter illumination, an additional line or two could be read from any point in the room. The apparatus for exposing letters for short intervals was so adjusted that under an intensity of 1½ to 2 foot-candles the letter could not be identified from most parts of the room, whereas when exposed for the same interval under an illumination of 12 to 15 foot-candles it was easily read. It was shown by these two demonstrations that under adequate lighting one sees more and sees more quickly, and is therefore able to proceed with his work more accurately, and also more quickly, or with less fatigue. It became evident that good lighting is a part of the safety equipment of an industrial plant.

The importance of differences in brightness, that is, light and shade, in revealing the form of objects was portrayed when the three wooden bars in the shadow box were illuminated from different directions. Their appearance was substantially identical when illuminated equally from four sides, but with the light largely directed from one side, they stood out distinctly as being round, square and flat.

Glare has long been felt by illuminating engineers to be the greatest drawback to proper illumination, although the popular mind has never been able to picture and conceive of its harmful and insidious effects. Glare manifests itself in numerous ways and should be guarded against as much as possible by fool-proof units.

By increasing the voltage on the lamp behind the glare chart, the smaller letters near the bright spot became obliterated, evidencing the truth of the statement carried on the chart, "A bright light near the line of vision greatly reduces one's ability to see detail." As the brightness was further increased the chart could be viewed only with discomfort. Thus the effects of glare, both in interfering with vision and in causing discomfort, were emphasized. The effect of the position of the light source with respect to the eye was indicated by raising and lowering a bare lamp above the platform.

Reflected glare from bright surfaces was apparent in the tinned pans. The value of the bowl-enameled lamp and the enclosed diffusing unit in minimizing the effects of such images of the units was clearly demonstrated.

Lantern slides were used in emphasizing the importance of maintenance for lighting systems, as well as in the direction of other points.

It is believed that demonstrations of this character in cities throughout the country is a sure means of popularizing lighting to such extent that factory managers will be able not only to analyze their own lighting problems and to safeguard themselves from inadequate and improper illumination, but also to recognize and take advantage of the possibilities for profiting through light applied as a definite part of the producing equipment of the plant.

Panorama of Southwestern Ship Yard showing angle park and outfitting yard.

Industrial Yard Lighting

BY A. G. HUMPHREY AND R. G. TAPLIN

(Exact methods of installing lighting equipment for the illumination of large outdoor spaces are here described by Humphrey and Taplin, electrical engineer and industrial engineer respectively, of the Southwestern Shipbuilding Company of San Pedro, California.—The Editor.)

In an industrial plant where large outdoor areas are in use for storage and for processing, such as the fabrication and assembly of structural materials, it is essential, if the daily production is to be continuous through two or three shifts, that the yard areas be adequately lighted. In designing an installation under such circumstances three principal factors must be the basis: first, the provision of a fair amount of light throughout the storage areas; second, such intensity of illumination at the working plane in the fabricating and assembly areas as will promote the maximum efficiency of the men at work, and such distribution as to eliminate shadows and dark spots; third, the creation of flooded areas where more intense illumination is required, or where it is not practicable to erect lighting poles or standards.

In the construction of the plant of the Southwestern Shipbuilding Company, at East San Pedro, California, the above requirements were well exemplified, for here, due to the climatic conditions, a large proportion of the punching, shearing and bending, and practically all the fabricating and assembling, are accomplished in the open. In this plant the requirements were met by the use of high poles, angle reflectors on the walls of the buildings of sufficient height and flood lights set on towers or stands on the roofs of buildings.

Poles are located in the steel storage area, the "Angle Park," where punching and bending are done, and at such other locations as would not interfere with the movement of materials. These poles are fir sticks, ranging in length from 65 to 100 feet, and set in concrete footings to a maximum of 8 feet below the yard grade. Feeders to these poles are three number ten rubber covered wires laid in one-inch metal conduit at an elevation of about 1.5 feet below grade, where they enter 30-ampere, 250-volt, three pole, single throw, fused, Square D switches. From these switches the wires are continued up the poles in three-quarter inch conduit to Type F-2 condulet bodies with three-hole porcelain covers. One foot below the top of each pole are placed four branch arms of one-half inch conduit, each extending three feet from the pole and ending in a gooseneck. These branch arms are erected in pairs, each pair passing through the pole, and each provided with one C-1 condulet body with porcelain cover, located close to the pole, the two condulets being in the arms adjacent to the feeder. The wires are carried from the F-2 condulet to the branches through the C-1 condulets, one side of the three-wire circuit feeding two lamps through each pair of branch arms. On the other end of each branch arm are located one X5509, Benjamin, shallow bowl, mogul base, distributing type reflector, with a 400-watt Mazda C lamp, giving a total of four lamps and 1600 watts per pole.

These poles are so distributed as to give an average of 1 foot-candle intensity on a plane 3 feet above the yard grade in the storage area and 1.5 foot-candles in the "Angle Park" working area. Further intensity was provided at each machine by means of individual, low wattage lamps, both fixed and portable, as circumstances required.

It will be noted from the foregoing that each pole is separately controlled through a Square D switch. This provides a very flexible arrangement, making it possible to reduce, at will, the number of units in service. When the working force is reduced to one or two shifts only such poles are used as are required to provide general illumination.

The general illumination of the Outfitting Wharf is provided for by poles similar to those in use in the yard. This wharf is 1100 feet in length and is served by six poles each 90 feet long. These poles are jettied into the bay along the shore side of the wharf and tied to the main wharf piling by bolts and U clamps. Each is provided with one number 1203, Benjamin, multiple street lighting unit, mogul

base, and a 400-watt Mazda C lamp, mounted on a one-half inch conduit, goose-neck bracket, with the lamp 2.5 feet from the face of the pole and 55 feet above the wharf deck. The lamps are fed from two number 12, rubber-covered wires, laid in one-half in.

Plate shed illuminated from angle reflectors and floodlight towers.

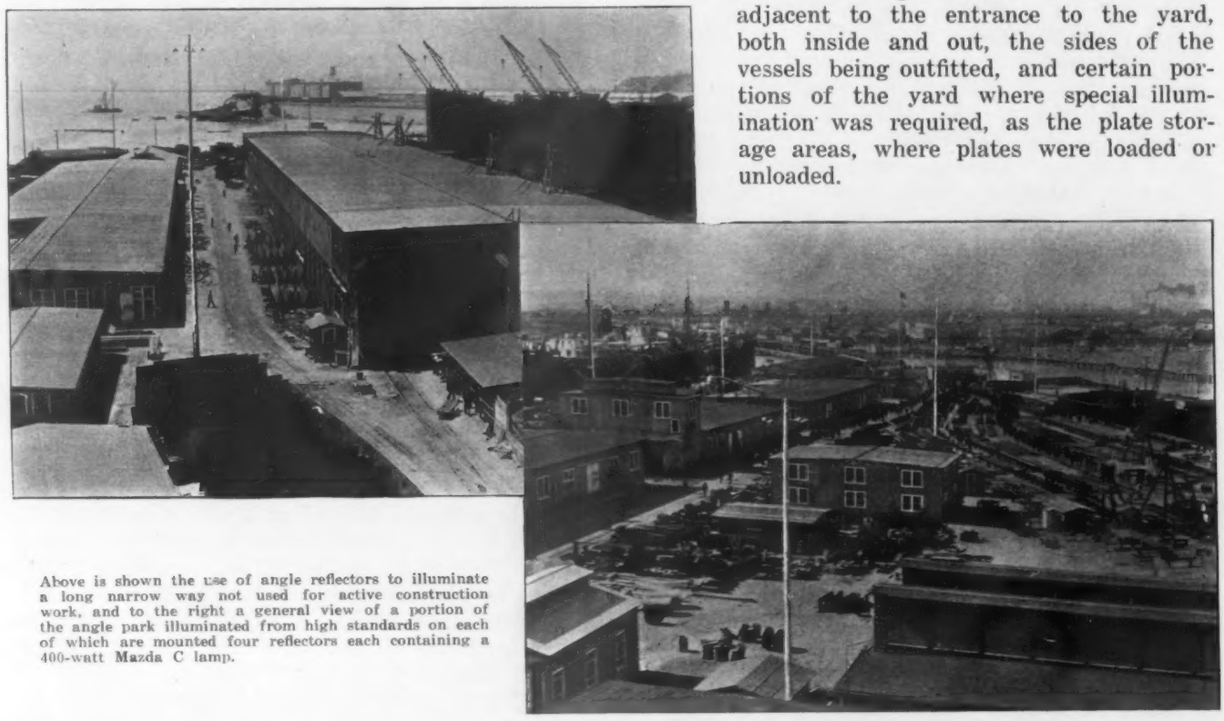
conduit and controlled by a 30-ampere, 250-volt, three-pole, single throw, Square D switch set on the pole.

Between the Plate Shed and the Slipways is an area approximately 600 feet long and 80 feet wide. Forty feet of this width, extending from the Plate Shed to a standard gauge trick, is used for the assembly of girders, columns, etc. This area is lighted by 400-watt Mazda C lamps in number 5537 Benjamin angle reflectors, spaced 22 feet centers along the wall of the Plate Shed at a height of 32 feet above the ground. There are 24 of these units, controlled by six 30-ampere, 250-volt, Square D switches mounted on the timber columns of the Plate Shed. The intensity of illumination in this area is 4.5 foot-candles at a point 25 feet from the building.

Located on the roof of the Plate Shed are four timber framed towers, on each of which are set three 500-watt Davis flood lights each containing a 400-watt Mazda C lamp. These lamps are so set as to flood the areas adjacent to and between the heads of the six shipways and give most excellent and satisfactory illumination to this space, as well as providing general illumination along the length of the passage ways and steel plate storage racks between slips.

Local illumination on the shipways is provided by 100-watt lamps in shallow bowl, steel enameled reflectors set on 4 x 4 in. posts above the staging. and by strings of 60-watt Mazda C lamps in weatherproof "shurlok" sockets strung on weatherproof wire. By these means all parts of the staging and the decks of building vessels are adequately lighted and the possibility of injury is reduced to a minimum.

Protective lighting was provided during the period of the war by four searchlights of 500 and 1000 watts capacity, set in timber towers located at such points as to permit the guarding of all approaches to the plant. For this purpose were used Davis flood light units with searchlight reflectors, so mounted on swivel bases as to sweep the entire property line at will. The searchlight towers are fed by a three-wire, 220/110 volt circuit. The lamps are fed from either side of this circuit through a switch so arranged that should the fuses blow on one side the other side can be thrown into service. In addition to these towers, 500-watt Davis flood lights, with 400-watt Mazda C lamps, were mounted on stands or brackets on the roofs or walls of several of the buildings so as to flood the areas adjacent to the entrance to the yard, both inside and out, the sides of the vessels being outfitted, and certain portions of the yard where special illumination was required, as the plate storage areas, where plates were loaded or unloaded.



Above is shown the use of angle reflectors to illuminate a long narrow way not used for active construction work, and to the right a general view of a portion of the angle park illuminated from high standards on each of which are mounted four reflectors each containing a 400-watt Mazda C lamp.

On each of the seven cranes, of the tower type, the boom carries special brackets with four dome reflectors, in each of which is a 400-watt Mazda C lamp, thus providing adequate local illumination for the handling of fabricated sections, plates and machinery to the hulls. On each side of the crane cab is attached an angle reflector, so placed as to light the crane tracks.

Engineering department offices and slipways. General lighting from mast lights.

This briefly outlined lighting scheme was the result of a careful study of the general layout of the plant, and the selection of equipment which appeared best adapted to the service demanded. The result was a well balanced and most adequate illumination of the entire yard for all purposes, and provided a generous and economical amount of light to all working areas, and accomplished the measure of protection deemed necessary. No accidents due to lack of sufficient lights have occurred, and night work has proceeded at the maximum of efficiency and without complaint insofar as illumination was concerned.

The maintenance of the equipment has been found to be a minimum due to the sturdy nature of the installation. No difficulty has been experienced with the conduit work, and this has contributed largely to the minimizing of interruptions which would have caused expensive loss of time.

The Foot-Candle Meter and Its Part in Better Lighting

BY W. M. ROSBOROUGH

(To educate the public in the terminology of illumination required that a means of easily and quickly measuring light be evolved. The result of the researches was the Foot-Candle meter which is here described by the assistant to the Pacific Coast manager of the National Lamp Works of the General Electric Company.—The Editor.)

There is a general recognition in lighting circles of the fact that illumination has assumed a new status. We have had electric lighting in our industrial plants for many years, as well as in our stores, our offices, and homes, but the interest on the part of the user has not extended far beyond the paying of the monthly bill or the renewing of a burned-out lamp. To him, light has been light, something obtained at the snap of a switch; it has enabled him to see and that is as much as he cared about it; it has been satisfactory or it has been unsatisfactory. Gradually, however, the efforts of illuminating engineers have been bringing results. These men have long recognized the distinction between mere light and real illumination. They have consistently labored to interest the purchaser in buying an effect rather than a cause. They have established simple units of light measurement and have reduced to a science those things that happen between the time when the light leaves the lamp as candles or lumens and when it registers its impression on the eye. Tests conducted in industrial plants where the lighting has been planned according to the principles laid down by these illuminating engineers have proved that their theories are correct and that substantial increases in production may be obtained at extremely small increases in the cost of plant operation by substituting adequate illumination for poor or mediocre lighting. The progressive factory manager now regards lighting as something which he can use to very positive advantage rather than as an unwelcome necessity which he is forced to tolerate. It has become in his mind a definite part of the producing equipment of the plant.

It has taken years for the appreciation of lighting to grow to its present proportions, and there are

The first foot-candle meter.

no doubt many reasons why this has been the case. One of the chief reasons has been, however, that light has not been readily measurable; it has been difficult to compare the illumination in different plants or between different sections of the same plant. It has been correspondingly difficult to evaluate the effect of lighting in increasing production, decreasing the accident hazard, improving the quality of the product, and improving the morale of the operatives, because the basis for comparison has been lacking. It is true that light measuring instruments have long been available but these have been complicated, from the standpoint of the layman, and they have not been adapted for convenient use. The development of the foot-candle meter, which measures light almost as readily as a thermometer measures temperature, has placed the means for measuring light within the reach of the plant executive himself and the manner in which he has taken to it is evidence of the satisfactory manner in which it is filling a real need.

The meter with leather carrying case

The first instrument that was called a foot-candle meter consisted of a box which contained a battery, rheostat and voltmeter, and a test or light box comprising the scale with its translucent holes and a little miniature lamp. This light box was entirely separate from the battery box, but electrically connected to it by a flexible cable. The battery box had a compartment for carrying the little light box; by means of a leather strap handle the whole outfit could be carried around as easily as the ordinary electrician's set. Fig. 1 shows the construction of the first foot-candle meter. This instrument was quite satisfactory for a beginning. The little light box could be placed in any position and could be controlled from the battery box. The whole apparatus, however, was rather heavy and lacked the convenience and portability features so essential to making it truly successful.

From time to time, changes in design were made for the purpose of making the instrument lighter and more compact. By rearranging the parts and substituting lighter materials, the present model, as shown herewith, was produced. It is the result of very earnest efforts to develop a neat, portable photometer, reasonable in price and accurate enough for most purposes. The utility of an instrument of this kind is great; at the time of this writing approximately 3000 foot-candle meters are in service and the demand for them is growing constantly.

An important and far-reaching result of the use of this instrument, already becoming apparent, is in its inducement to form the habit of thinking in terms of foot-candles. It is the common practice for the butcher to "heft" a roast and to estimate its weight before placing it on the scales. He takes pride in his ability to estimate weight, for a knowledge of weights and measures is part of his stock in trade. Knowledge of illumination values is part of the lighting man's stock in trade. With the foot-candle meter as his companion, he thinks and talks in foot-candles just as the butcher talks in pounds. The foot-candle meter gives the lighting man a new prestige. It is the clinical thermometer that dignifies his profession above that of the vendor of a patented product.

The foot-candle meter in its present form

The foot-candle meter measures light at the work

Formerly, the man selling illumination talked earnestly with the manager about the lighting in his shop or factory but was forced to confine himself to generalities and consequently often found it difficult to effect changes which would have been a real service to his customer. With the foot-candle meter, this difficulty is largely overcome.

Most men like to be "shown," and the factory manager is no exception. Experience proves that many executives take pride in lighting systems which are very much at fault. The fault may be in the lack of proper diffusion of light or in the location of the light sources, or in the amount of light supplied. The foot-candle meter will not bring all the faults of a lighting system to surface, nor will it always tell what medicine is required, but, as the hydrometer indicates the exact condition of the storage battery, so the foot-candle meter indicates the condition of the lighting. The cure must often rest with the lighting specialist. The assistance of such specialists is readily available as a part of the lighting service supplied by all progressive lamp and reflector manufacturers.

Finding out how much light reaches his desk.

Besides assisting in the movement for better illumination, this little instrument has been found extremely useful in the proper maintenance of lighting installations. In one large establishment where the superintendent uses a foot-candle meter systematically as a check on his maintenance department, readings of illumination intensity are taken at regular intervals at fixed stations throughout the plant. These readings are recorded in such a way that the successive readings are readily comparable, and when any inconsistency appears in the records an investigation is made and the proper remedy applied. Tests have shown that the value of lighting does not lie entirely in the first four foot-candles, nor in the first ten foot-candles, but that all foot-candles above these values contribute to the increased production of the plant. The importance, then, of getting all the foot-candles which the system is capable of providing, and which are being paid for whether they are lost in dust and dirt or not, is evident. Not infrequently, only one-half or even one-third of the light paid for is delivered; the use of the foot-candle meter avoids heavy losses of this character.

Practical Application of General Lighting Safety Orders

BY R. L. ELTRINGHAM

(A further explanation of the application of the General Lighting Safety Orders of California is here given by the Electrical Engineer of the Industrial Accident Commission which body has the enforcement of the Orders under its authority.—The Editor.)

The General Lighting Safety Orders issued by the Industrial Accident Commission, which became effective December 1, 919, were drafted to create a reasonable minimum standard for illumination in all places of employment in the state of California for the primary purpose of protecting the sight and general health of employes. A casual study of the advantages of good lighting will reveal many interesting facts bordering upon economy and efficiency.

It is with the hope of making clear the application of these Orders that this brief article is written. It should first of all be thoroughly understood in taking up and discussing those cases which come up in every day practice that the intention of these Orders is to require a minimum distribution of light, whether accomplished by natural or artificial means, or a combination of both during the period of the day that the premises are occupied.

Lighting Industrial Buildings —

In the design of industrial buildings provision for ample distribution of natural light is indeed an important factor, as no source of artificial light can compare with that of the sun, although a greater intensity for day lighting is required than for night lighting. While the mandatory foot-candle intensities for various conditions and classes of work appear under Order 1503, it is strongly urged that in the design of a lighting system, the intensities recommended for different industrial processes appearing in the appendix, more particularly from pages eleven to twenty-two inclusive, be given careful consideration.

The requirement for shading lamps for overhead lighting as set forth in Order 1505 may appear to many as somewhat technical, and for that reason create a doubt as to what should be accomplished. The diagram on page seven of Order 1505 indicating a definite relation between elevation above eye level and horizontal distance from the light source, simply establishes what is commonly termed "line of vision."

The intrinsic brilliancy or the intensity of light per unit area of the luminous source in the case of a bare Mazda C lamp is not only harmful to the eye, if placed in the line of vision, but indeed ruinous to sight. This is also true in no small way of Mazda B lamps, similarly located.

The Line of Vision —

Just what do we mean by "line of vision"?

Perhaps the simple way to explain it would be to say that an unshaded lamp so placed that the direct ray from the luminous source will strike a person directly in the eyes from any location assumed by him during the ordinary performance of his work is in the line of vision and should be shaded. The shading of lamps for local lighting is also important and should be given attention in each particular case for the same general reason as mentioned above. It may be said that, with few exceptions, the types of lamps

used today to produce efficient lighting will come under this shading requirement.

Emergency Lighting —

The section of the Lighting Orders about which there seems to be considerable doubt under the subheading of Emergency Lighting is Order Number 1508. It is hoped that the small type notes, number one and number two, under Paragraph A of Order 1508 will serve to make clear the intent. The required intensity for emergency lighting is one-quarter foot-candle, this intensity to be distributed to all workspace aisles, stairways, passageways, exits, outside landings of fire escapes, etc.

It might be well to set out more clearly what is meant by workspace aisles, it being assumed that other specially mentioned locations need no further definition. In the case of assembling plants, erecting shops, foundries, machine shops and other industrial spaces where it is impractical definitely to lay out passageways leading to the outside, emergency lighting should be distributed over the entire area under the caption of workspace aisles.

Quite frequently questions are asked concerning emergency lighting in storehouses and general storage spaces, plans for which are submitted for approval which are decidedly sketchy in character. In many such instances it is intended to build long tiers of shelving carried from floor to ceiling for the storage of miscellaneous merchandise. In cases of this kind, the regular lighting and emergency lighting systems should be located in the definite passageways formed by such shelving. Where the shelving is not carried to the ceiling and material would not interfere with light distribution, the emergency circuits could well be placed on the ceiling.

A great deal of misunderstanding and doubt would be cleared away if those concerned with this question generally would have what is desired to be accomplished definitely fixed in their minds and make calculations accordingly. The emergency lighting should be considered a part of the general illumination and, hence, should be used concurrently with the regular lighting, doing away with the necessity of turning on the emergency upon failure of the regular system, thereby experiencing no interruption.

Emergency Lighting of Public Buildings —

Paragraph A of Order 1508 requires a separate source of power supply independent of the regular lighting system in theaters, public meeting halls, moving picture exhibition places, hospitals, etc., to supply the emergency lighting system.

In the case of theaters, public meeting halls, moving picture exhibition places, hospitals, schools, etc., it will be necessary that the emergency lighting circuit be equipped with an automatic throw-over switch that, on account of failure of the regular source from which the emergency lighting system is normally to be supplied, the automatic switch would, without manual intervention, transfer the emergency lighting circuit to the auxiliary source of supply. In many instances, owing to a single power company in the locality, a storage battery will have to be resorted to. The question of failure of the storage battery when needed, due to lack of maintenance, has been raised. To offset this contention adequate battery service can now be furnished in the smaller communities by those engaged in the battery-service business and frequently the direct representative of the battery manufacturer.

The emergency lighting system should be installed and controlled so as to present the least possibility of interruption by having fuse cabinets backed and flush switches of the key type. In Order 1509 reference is made to pilot or night lighting which may be a part of the emergency system. The object of pilot or night lighting is to afford sufficient light for the night watchman safely to make his rounds without the need of a lantern or flashlight.

The Location of Switches —

The switches controlling night lights should be so located in relation to the entrance that the watchman or any other person may enter the building at night and light his way ahead. Take for example a store with stairway and elevator in the rear leading to the basement and upper floor. A switch should be located at the entrance to turn on sufficient light to enable a person to find his way to the stair landing or elevator in the rear, and another switch at the stair landing to light his way either up or down, enabling him further to light up the basement or upper floors and turn off all the lights as he leaves the building. All emergency light-circuit switches should be plainly identified by stencil or plate on fuse cabinets and placing switches on conspicuous targets or otherwise by distinctive marking. Emergency light circuits should be protected by fuses in the same manner and kept separate and distinct from the regular lighting system.

Suggestions which may prove helpful in laying out lighting systems are contained in the appendix to the Orders which is advisory in character and not in any way mandatory.

ELECTRIFICATION OF THE STOCKHOLM-GOTEBORG LINE

The Second Chamber of the Riksdag recently adopted the resolution previously acted upon favorably by the First Chamber, appropriating 23,000,000 crowns ($6,164,000) for the electrification of the railroad line Stockholm-Goteborg, the amount to be expended during the year 1921.

The action of the Riksdag may be taken as a sure indication of the purpose of the Government to bring about the electrification of the entire system of the state railroad in Sweden. The bill now only awaits the Royal approval, which will no doubt be given.

There ought to be good opportunity for American electric companies to present bids for the work, and it has been suggested in a commerce report that they write to "Kungliga Jarnvagsstrelsen," Stockholm, Sweden, for particulars.

A group of tropical shrubbery which usually was a dark blot at night, was transformed into a mass of fairylike tracery by electrical illumination, every frond and twig thrown into relief by carefully concealed lights.

Garden Illumination

(Not only use but beauty is among the functions of electricity, and illumination as a form of decoration, indoors and out-of-doors, is becoming every day more popular. Following is an account of the garden illumination which delighted the guests at the N. E. L. A. Convention at Pasadena.—The Editor.)

The illumination of the grounds of the Hotel Huntington during the recent N. E. L. A. convention at Pasadena was a fine example of the exquisite effects which can be secured with this form of decoration.

In the Japanese gardens of the hotel are four small ponds located on different terraces and connected by streams running the length of the garden. These are surrounded by many varieties of Japanese ferns, palms, dwarf oaks and bamboo trees against a background of large oaks and eucalyptus. Six 500-watt floodlights mounted at heights of from 25 to 35 feet, each equipped with 400-watt Mazda C Sunbeam lamps, covered the main section of the gardens and also illuminated the tall eucalyptus trees.

On the left side were located eight 500-watt Western Electric floodlights, each equipped with 400-watt Mazda C Sunbeam lamps which were focused across the garden and illuminated the shrubbery on the right hand side of the canyon, and also covered the lawn and pools with wide angle rays from the same units. On the right-hand side were located six 500-watt Western Electric Davis floodlights each equipped with 400-watt Mazda C Sunbeam lamps used at wide angle flood settings to cover the center and left-hand side of the garden. These lamps were located at an angle that removed any glare from the hotel buildings, thereby allowing guests the opportunity of viewing the grounds without looking directly into the light from any of the lamps used.

In the center of the hotel building, and approximately one-quarter of an acre in extent, is a garden with a large bed of flowers and date palms, bordered by tropical plants, palms and large trees. The center section and palms were illuminated by four Western Electric Utility units each equipped with 200-watt Mazda C Sunbeam lamps. The oak and large palms in the border were illuminated by two 500-watt Mazda C Sunbeam lamps. The low border plants were illuminated by the use of Benjamin elliptical angle reflectors set in the ground.

The main tropical gardens are located at the northeast side of the buildings and cover approximately two and one-half acres. They consist of tropical flowers, ferns, palms and small plants, the banana palms in the center being 30 feet high.

The borders are of ferns, palms and shrubs, and the border running around the main garden consists of fern trees, tropical flowers of delicate coloring and texture, fuchsias and cyclamen of varying types and colors. This whole group was illuminated with a combination of utility units, floodlights and reflectors, every detail in the graceful feathery foliage being admirably brought out.

Directly in front of the hotel entrance are located two large fir trees and large clumps of bamboo. These were illuminated from the roof of the

hotel building by the use of three 500-watt Western Electric Davis floodlights and one 1000-watt Western Electric Davis floodlight was used to bring out the detail of tree-tops.

A. G. Humphreys and J. G. Loomer, to whom goes the credit for the design and installation of the lighting effects described in the accompanying article.

All the gardens were illuminated from the ground, thereby bringing out the delicate tracery of the foliage and flowers, giving the greatest effect in the color scheme.

The contrast between the daylight photographs and the same scenes taken at night showed the wonderful possibilities of the floodlight when used in the proper manner, as all of these units were located at angles which threw the light directly on the shrubbery and plants and still eliminated any unpleasant glare while looking at the gardens. The units were practically hidden by the plants and ferns.

The total number of units used was 93 and the total consumption of power equaled 30 kw.

The entire lighting effect was laid out and installed under the personal supervision of A. G. Humphreys, Electrical Engineer of the Plant Department of the Southwestern Shipbuilding Company, East San Pedro, California, and Mr. J. G. Loomer, of the Western Electric Company, Los Angeles, Floodlight Expert.

SELLING MAZDA LAMPS

BY CLARENCE LLEWELLYN

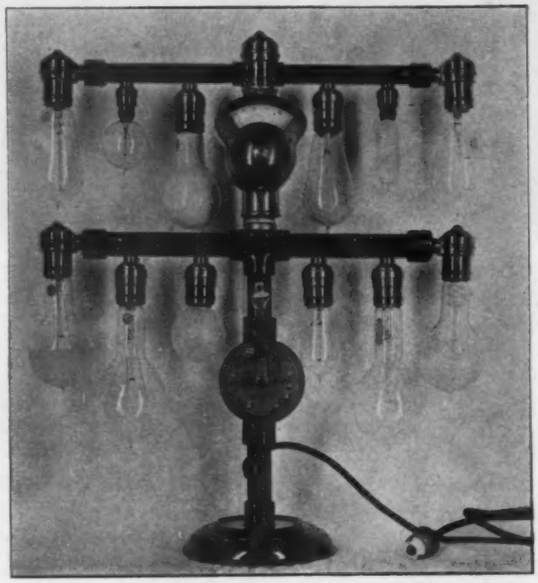
(This story of the Los Angeles Electric Appliance Shop contains many valuable suggestions concerning the sale of lamps, shop location, and general selling policy.—The Editor.)

Doing more than a one hundred-dollar retail business on Mazda lamps over your counter without sub-contracts or without doing wiring contracting, is considered a pretty good business. After having used several kinds of display racks, we have designed one which has been responsible for a great part of our increased sales. This device makes it possible to show the customer how much current the globes use, and if the clerk is busy with others, the customer can decide himself upon the type of globe he wants.

It has always been the custom of our shop to have extra globes on hand when stock is short. In order to make this possible, I built a frosting machine three years ago. If every lamp agent would put in his own frosting machinery, his stock could be from one-half to two-thirds less than what he now carries. Furthermore, I believe that the lamp manufacturers will welcome this idea, because their supply is so limited that they are now employing extra help in order to check over agents' stock so that dead stock may be removed and every agent may have his full quota. We have found it necessary to do special work such as making bull's eyes, half frosting and bowl frosting for our customers.

Making a Record —

When I started in business, three and one-half years ago, I had just twenty dollars. Today I have what I consider the prettiest shop in the heart of Los Angeles. My rent is half of a $533 per month store room. The other half of this store is a typewriter shop. The two lines go well together. My success here leads me to advise men going into the appliance and Mazda lamp business to locate in the heavy traffic or shopping districts of their city. Our appliance and lamp sales, not including such stock as washing machines and vacuum cleaners, will run about six hundred dollars this year. I always plan to be in the front of the shop so I can get acquainted with customers when they enter the store.



By pressing the correct button, the current consumption of any one of the dozen lamps is registered on the attached ammeter. This is a simple and effective way of helping the customer decide upon the lamp best suited for his purpose.

There are but a few standard makes on the market and for this reason the use of so many name plates is really undesirable. They mean nothing and in time make for more trouble and the necessity of carrying a larger stock. Many dealers think they have to carry the sample of an appliance that they don't sell in order to knock it. This does not bring profit and is of course unfair.

Method of Selling —

I like to pick what I think is best and offer that to the customer, allowing him to make his own final decision. Often in selling what I think is best, I am considered a nut by the customer, because many have no idea of what is inside the appliance. If two customers entered your shop at the same time and one wanted to see an appliance and the other wanted a lamp, what would you do? We give the first attention to the latter, for in so doing we feel we are working best to establish permanent trade.

The Dealer's Window By Night

(The electrical store has come to be the brightest spot in its neighborhood after dark, the attraction which draws window shoppers from their aimless wanderings to the inspection of its bright nickel and attractive appliances. The photographs given below of Western stores which are taking advantage of evening as well as daylight hours to carry their message of good merchandising are instances of what is possible in setting an example of good window illumination which may be followed by other merchants of the neighborhood.—The Editor.)

The best time to advertise the mazda lamp is at night, a fact which was realized by the Hanbridge Electric Company of San Francisco and which resulted in this effective window. The mission here shown is made from the lamp cartons painted an adobe color, set in a background of grass sod and ferns.

The colorful windows of the Sullivan Electric Company of Modesto, California, are most attractive after they have been illuminated for the evening. The tasteful and natural arrangement of furniture and appliances appears to good effect in the light of fixtures similar to those which would be used in the home in similar surroundings.

Fixtures were meant to be displayed at night time and nothing is more attractive than a well arranged grouping of lamps and wall brackets. The low curtain which forms the background for the windows of the Valley Electrical Supply Company of Fresno places the entire store in the window.

In the daytime the interior of the store is darker than the street and must compete with many other attractions, but at night it may be made to stand out so that the passerby feels that he is standing in the midst of the stock which is so brightly illuminated. The customer picks out what he will buy tomorrow.

An example of the effective lighting of a window with a scattered display. The concentrating of the light has the same effect in unifying the group that the mammoth battery with its background of drapery has in the daytime. Every window, as every picture, should have a "center of interest."

One of the features of the N. E. L. A. convention at Pasadena was the windows of the electrical stores in town, which were especially featured for the occasion. None attracted more attention than that of the H. L. Miller Company, which combined beauty of design with motion and color.

Electric Sign Manufacture

BY R. E. SMITH

(Western manufacturers have invaded nearly every line of industry followed anywhere in the country. The following article describes the processes and plant of the Electrical Products Co. of Los Angeles, who make a large part of the electric signs sold in Southern California.—The Editor.)

It does not seem easy to standardize such a business as sign manufacture where one of the principal sales points is individuality and each article is produced from a special design. But this is exactly what has been done in Los Angeles by the Electrical Products Corporation which has so organized its shop procedure and methods that the work moves from one department, and from one bench, to another in much the same way that automobiles move through the most modern factory which produces the large number of machines commonly met with.

The general outline of the process, for it is a process and not a job-order system, is as follows: When an order starts through the shop the first step is the cutting of the tin faces of the letters. This is done in the tinsmith's department which follows standardized forms unless the order calls for special shapes of letters. In this one step there is a great saving in time and material as the workers become familiar with the usual shapes and lose no time in executing the design. After the faces are cut the galvanized channel iron sections for the ends and sides are assembled. The sections are purchased in quantities of the sizes usually required and a further saving is effected by reducing hand work at this point.

The home of the Electrical Products Corporation of Los Angeles. These producers of electrical signs have been especially successful in organizing their work along the lines of modern large scale production.

The other steps follow in rapid succession. The receptacle strips—also on hand in standard lengths—are added by one man and the sign moves on to the wireman. This step is practically uniform for all signs, consisting of the addition of the receptacles themselves and the wires connecting them. Following this the luminous facings for the letters are added and the sign is ready for the paint shop where the specified colors are put on. Meanwhile the blacksmith department has made the hanging rig or fabricated the support, if the sign is a large one, and the sign is complete for placing in the shipping crate which the woodworking department has made in the interim.

The plant maintains a continuous schedule for production, turning out on the average nine complete signs daily. The time taken during the regular production program is such that about one hundred signs are in the shop at any one time, and a working force of forty to fifty men is employed.

As an example of what other manufacturing plants on the Pacific Coast may expect in the way of growth, the evolution of this company is of interest. Starting in 1912 with a ground space of 1600 square feet, the business has expanded to fill a building having over 17,000 square feet of floor area. From a purely local market the firm now sells in China, Japan, Hawaii, Manila and the west coast countries of Central and South America. This latter business is all through mail orders although generally the foreign orders are consummated through export firms who handle the financial end.

Some years ago the company entered the field of making and operating interchangeable signs for theatres and has found this to be a very profitable business. Another somewhat similar field has been the manufacture of complete theatre electrical lighting apparatus such as footlights' strips and borders. They also design and install interior decorative lighting installations.

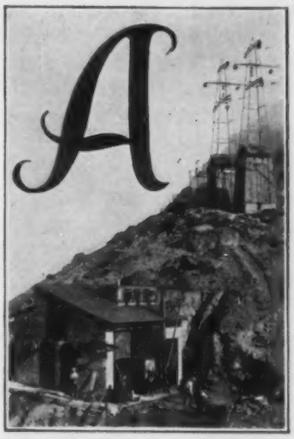
PAMPHLETS AND CLIPPINGS IN THE BUSINESS LIBRARY

The Journal of Electricity has the pleasure of announcing that it has secured for the benefit of its readers a short series of articles on this timely subject. Business offices today are flooded with pamphlets, leaflets, newspaper and magazine clippings, and the difficulty that confronts business offices is how to handle effectively this flood of valuable print. The Journal of Electricity has arranged to publish a series of five articles entitled "Pamphlets and Clippings in a Business Library" that will discuss their value as sources of up-to-date information, where the best pamphlets on any given subject can be obtained and the best method of filing them for ready reference. The series of articles will be written by Miss Virginia Fairfax, Librarian, Carnation Milk Products Co., Chicago, formerly of the Publicity Department of Robert W. Hunt & Company, Engineers, Chicago.

Electric Power for Mining

BY F. S. VIELE

(The dependence of Western development upon electricity is nowhere more marked than in agriculture and mining. An interesting account of developments supplying the latter industry is given in the following article by the president of the Arizona Power Company.—The Editor.)



Jerome substation of the Arizona Power Company, 3000-kw. capacity, serving mines and smelters in the Jerome district.

ABOUT the first question asked by strangers contemplating mining operations in any district is, "Can we get power for such operations?" In a country where water is particularly scarce, and when available is often injurious to boilers, and where haulage problems are great and offer serious obstacles to the easy securing of fuel, the question of power, and particularly cheap power, becomes of paramount importance in any industrial development.

The present power situation in Yavapai county, Arizona, has been most satisfactorily solved by the Arizona Power Company, who furnish electric power from two hydroelectric plants aggregating 12,000 hp. and a modern steam plant of 10,000 hp. capacity.

The northern part of the county, in which are located the great producing mines which make the district so justly famous, is covered by extensive transmission lines over two hundred and fifty miles in length, by means of which electric power is delivered at the very door of every mine or prospect in the district.

That the cost of power from this source is satisfactory, at least to the users, is evidenced by the fact that every producing mine, and practically every prospecting company is using electricity furnished by the company.

In March, 1918, the customers served and the approximate demands of such customers was as shown below:

Customers	Hp. Used
A. T. & S. F. Railway	100
Prescott City Pumping Plant, Del Rio	100
Consolidated Arizona Smelting Company— Humboldt Smelter and Mill, Blue Bell Mine, De Soto Mine	1500
United Verde Copper Co., Jerome and Clarkdale	5000
United Verde Extension Copper Company	1500
Hayden Development Company	300
Prescott Gas & Electric Company	300
Big Pine Mining Company	300
Bradshaw Reduction Company, Crown King	300
Arizona Binghamton Copper Company	450
Copper Queen Mining Company	100
Big Ledge Development Company	350
Jerome Verde Mining Company	350
Pittsburgh Jerome Mining Company	100
Arkansas & Arizona Copper Company	100
Jerome-Portland Copper Company	75
West United Verde Copper Company	200
Gadsden Copper Company	300
Green Monster Mining Company	250
Jerome Del Monte	150
Locey Pabst Gold Mining Company	100
Verde Combination Copper Company	250
Dundee-Arizona Company	200
Shannon Copper Company	200
Cottonwood Township	100
Mayer Township	50
Total	12,825

The Arizona Power Company, incorporated under the laws of the state of Maine, was formed in 1908 to take over the interests of an Arizona corporation which had appropriated the waters of Fossil Creek.

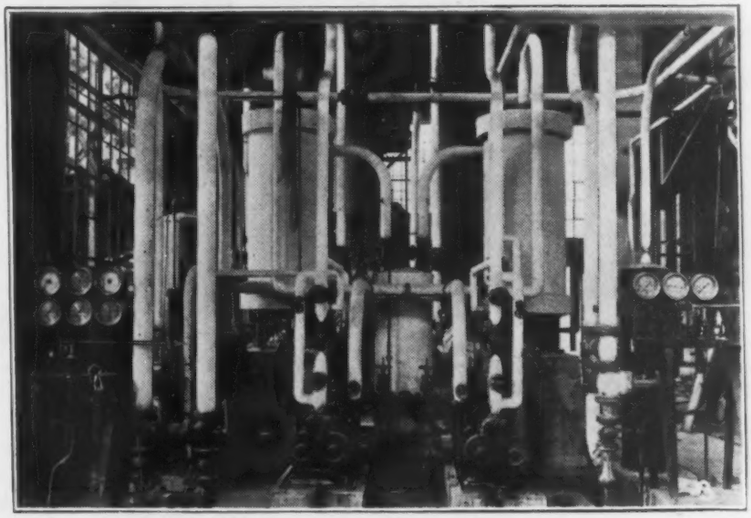
Water Source

Fossil Creek derives its name from the fact that the water covers sticks, stones and any foreign substance, with a formation which makes them look like fossils. The water evidently comes from a great depth, and gushes out abruptly from a rock cliff at a temperature of 72° Fahrenheit, with a constant flow of 43 cubic feet per second, absolutely the same in volume winter or summer, dry season or wet; that the quantity from the springs never changes has been proved by practically daily measurements since 1902.

From its source at the springs, located at the junction of Conconino, Gila and Yavapai county, Fossil Creek runs in a generally southeasterly direction a distance of about fourteen miles, where it empties into the Verde River. From the springs to the river the creek has a total fall of 1600 feet, and this fall is utilized in two hydroelectric developments, the upper plant using 500 feet and the lower 1080 feet.

About two hundred yards below the lower spring, a concrete dam is built across the creek bed, diverting the entire stream flow to a concrete intake tunnel, provided with suitable gates to keep out rubbish, logs, and so forth. From this tunnel the water enters a semi-circular steel flume, 5 ft. in diameter, carried on wooden trestles and supported on concrete footings.

The flume is laid on an hydraulic gradient of 1 foot to the 1000, the wooden trestle varying from five feet in height to sixty feet where bridges span



Pump system automatically supplying oil and steam for entire Tapco steam plant of the Arizona Power Company

the numerous small canyons. The length of flume from intake to the head of the pressure pipe is 22,000 feet, with an inverted siphon 480 feet in length, and having a drop of 146 feet, about in the middle of the flume. At the end of the flume a concrete box fitted with gates, cleaning racks and electrical devices to indicate to the power house operator the height of water in the flume, is connected directly to a steel pressure pipe 3300 feet in length which carries the water to a Francis turbine located at the creek level 500 feet below.

The pressure pipe is in the greater part of its course buried in the ground, and where exposed is supported on concrete piers. The turbine of 2500 horsepower capacity is directly connected to a General Electric 2300-volt generator of 15000-kw. capacity. The 3-phase, 60-cycle current as generated is raised by a bank of three transformers to 45,000 volts and transmitted to the main generating station on the Verde River eight miles away.

Storage System

The tail race of the upper or Irving plant empties directly into the intake of the larger plant, which is located at Childs on the Verde River. The intake is concrete and forms a pool 40 by 20 feet and 15 feet in depth. From this intake the water is carried on a grade of one foot per thousand to an artificial reservoir, Stehr Lake, having an area of 28 acres.

Stehr Lake forms a storage reservoir of sufficient size to carry the rated load of the Childs station unassisted for a period of 24 hours. The lake was formed in a natural depression of the hills by earthwork dams at either end. At the lower end of the lake, seventeen feet below the normal level of the water, is located the portal of a pressure tunnel which pierces the mountain 5200 feet, to the valley of the Verde River on which the power house is located. From the western end of this tunnel a reinforced concrete pipe four feet in diameter skirts the edge of the mountain a distance of 1400 feet to a concrete surge tank 30 feet in diameter and 36 feet high. The concrete pipe is under a constant hydraulic head of 30 feet.

From the bottom of the surge tank the water is carried in a steel pressure pipe 4800 feet long to the turbines in the power house 1080 feet below. The pressure pipe is 48 in. in diameter at the surge tank, 36 in. diameter at the power house, and for the lower half of the distance is of welded steel ¾-in. thick at the bottom. From this entire water conduit there has never been one minute's trouble in the nine years of operation.

Power House Equipment

The power house, located on the east bank of the Verde River, is of solid concrete construction with adjoining transformer house above and similarly built. Each of the three turbines in the power house has a rated capacity of 3000 hp. and each is directly connected to an 1800-kw. generator supplying current at 2300 volts, 3-phase, 60 cycles. Each generator is connected to a bank of three transformers which raise the voltage to 45,000 volts, for transmission.

The turbines are controlled by oil governors, and a special Tirrel regulator is provided to operate the exciters of each generator when they are working on the same transmission system.

Transmission

The transmission line passes from the east side of the river across the river and up the rim of the western mountain, a climb of 3500 feet over the most rugged country. In nearly an air line it is then carried to a switching station at Joland Junction on the Santa Fe, Prescott and Phoenix Railroad, a distance of 35 miles.

Considerable trouble was experienced from lightning on the line over the Verde River, at the commencement of operations, and a supplementary line on wooden towers was constructed up the Verde valley 51 miles to Clarkdale, the site of the United Verde Copper Company's new smelter, and thence to the Jerome sub-station. Each property is therefore able to secure power from two directions.

Concrete pipe, connecting pressure tunnel to pressure pipe at plant head, under about 17 ft. head

From sub-stations at Jerome and Clarkdale all of the various mines and prospects in the Jerome district are reached by taps from the main line or by 2300-volt distributing circuits.

In March, 1918, the transmission lines owned and operated were as follows:

Main Tower Lines	45,000 volts,	180 miles
Distributing Line	17,000 volts,	27 miles
Distributing Line	11,000 volts,	34 miles
Distributing Line	2,300 volts,	20 miles
Total of three-wire lines,		261 miles

or over 800 miles of copper transmission wire and steel groundwire.

It is an interesting fact that practically all of the copper wire was purchased from the United Verde Company's wire drawing plant at Perth Amboy, N. J., and it has therefore traveled east as bullion, back again as wire, and now serves to carry current to operate the mines from which it was originally taken.

In order to construct the two hydroelectric stations, it was necessary to build eighty miles of wagon

road from the railroad due east to the Verde River and thence to the springs. Sixty miles of this distance there was not even a trail before the work commenced. This road reached an elevation of 6,600 feet, and from the rim of the Verde River to the location of the power house at Childs, there is a drop of 3,500 feet in a distance of eight miles by the road. Over this mountain road by means of auto trucks, mule teams and burros over 60,000,000 pounds of freight has been transported.

Auxiliary Steam Plant

In the summer of 1916 the demands for power increased so rapidly, due to the wonderful development of the United Verde Extension Mining Company and the consequent impetus given to development operations in Yavapai county, that the water power plants of the power company were badly overloaded. In order to provide reserve capacity and take care of the present requirements, a subsidiary company, The Arizona Steam Generating Company, was formed to build a modern steam generating plant, which was located at Tapco on the Verde River, three miles north of Clarkdale. Construction of this plant was commenced in February, 1917, and the plant was placed in operation September 1, 1917.

The power house is located about half a mile from the tracks of the S. F., P. & P. Railroad, and is directly connected with the railroad by a standard gauge spur track 2800 feet long. The building itself is constructed of concrete throughout, with the exception of the western end, which has a corrugated iron finish, so that the future additions can be made with a minimum of expense. The boiler room is 110 ft. long, 75 ft. wide and 35 ft. high, and the turbine room adjoining it 66 ft. long, 40 ft. wide and 42 ft. high. The equipment is of the most modern construction and is designed to give the maximum of efficiency.

Fuel Supply

Oil fuel is used under the boilers, and immediately west of the present boiler room there is an oil unloading station on the spur track consisting of a concrete trough with four openings so that four carloads of oil can be emptied at one time. From this unloading tank the oil is pumped by electrical power to two auxiliary tanks back of the boiler house, which contain 24 hours' supply of oil, or to a large storage tank located about 1000 feet from the boiler house. This storage tank contains 30 carloads of oil, enough for one month's operations. The boilers are also arranged to use coal in case the change is desirable.

The water for the boilers is obtained from a well in the basement, and before being placed in the boilers the water is thoroughly purified of all foreign matter in a carefully designed laboratory located in one corner of the boiler room. From this laboratory the water is pumped to a feed water heater and from the feed water heater is forced by duplicate sets of pumps through the economizers and thence into the boilers themselves. The oil feed pumps, which are in duplicate, are located immediately in front of the water pumps and supply oil directly to the burners under the boilers. The amount of oil and steam for vaporizing is automatically regulated by the demands upon the boilers themselves.

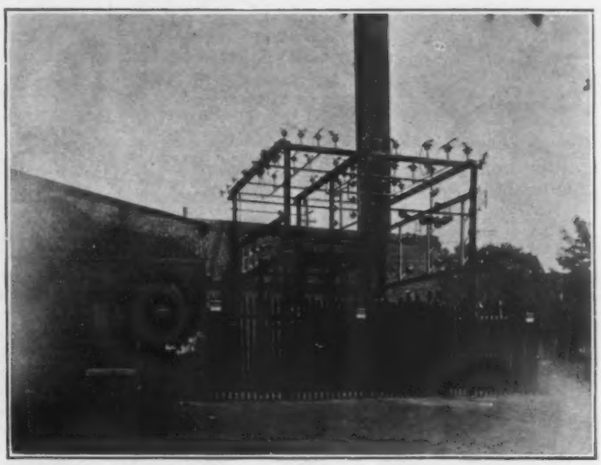
The generator, which is of 10,000-hp. capacity, has a specially constructed air cooling device which forces cool air through the windings of the generator and thence into the open air. The water circulating system for cooling bearings is operated from a large tank on the roof of the engine house, whence it flows by gravity through the bearings of the turbine and generator and thence through cooling coils immersed in the conduit which carries the condensing water to the condenser. From this point it passes to a large storage tank in the basement from which it is pumped to the tank on the roof by electrically operated centrifugal pumps.

The presence of this steam plant as an auxiliary reserve was deemed advisable by the directors of the Arizona Power Company to take care of the rapidly increasing demands of the Jerome district, and also to act as a guarantee against interruptions on the long transmission lines from the hydroelectric plant. The double transmission lines from the steam plant to Clarkdale are one mile in length. From the Clarkdale substation a new line is being built to the Hopewell Crushing Plant of the United Verde, and thence to the present Jerome substation. The liability to interruptions on the electrical circuits will be reduced to a minimum by the addition of this much-needed reserve and the company is prepared to add to the size of the steam plant as the demand of the customers requires.

In 1919 an extension 77 miles long of the transmission line was made to Phoenix and pumping power is now provided in the Salt River valley from the plants of the Arizona Power Company.

On an official test at full load conducted for three days, in November, 1917, the steam plant developed 335 kw-hr. per barrel of California crude oil, a result which is not surpassed by any similar size plant in the world.

A TIE-IN OUTDOOR SUBSTATION



Delta-Star Unit Type 3300/13200 kva., three-phase outdoor substation recently erected by the Canton Gas & Electric Company of Illinois. This station steps the voltage to 13290 volts for the line which goes to Lewiston and for tying into the 13200-volt line running to Canton.

Convention of California Contractor-Dealers

(Nearly two hundred members of the electrical industry gathered at San Jose for the annual meeting of the California State Association of Electrical Contractors and Dealers. A number of excellent papers were presented there and the spirit of the convention was one of cooperation with the other branches of the industry and the uplifting of the contractor-dealer branch to assure the public of better service. The California Association has done good constructive work in the past year and with the progressive program laid out for the coming year it will do much toward bettering the industry as a whole.—The Editor.)

Clyde Chamblin was re-elected president and is right now daring anyone to violate the code of ethics.

Cap Angus, California Cooperative Campaign, advertising the fact that advertising pays.

Clark Baker, National Lamp Co., Oakland, is probably thinking of a certain gentleman from Los Angeles.

We don't know what Glenn Arbogast was thinking about but he didn't do it that afternoon, anyway.

The keynote speech of the annual convention of the California State Association of Electrical Contractors and Dealers was made by Albert H. Elliot, counsel for the Association, at the banquet on the evening of June twenty-sixth. Speaking on "The Value of the Association" Mr. Elliot brought out the ideas that had been expressed throughout the entire convention in the papers presented, the discussion on them, and the action taken to insure the upbuilding of the industry and better service to the public. The convention was a complete success from every point of view and the intense interest shown by the delegates in all of the proceedings proved the desire of all to cooperate to the fullest extent with all branches of the industry to make this a banner year for the electrical trades.

The business session of the convention was opened by a discussion of Garnett Young's paper, "Cooperation With Architects and Builders," by Clyde L. Chamblin, San Francisco, president of the state association.

In discussing this paper Mr. Chamblin stated that the California Cooperative Campaign had carried out all of the plans outlined by Mr. Young with great success and mentioned the good work being done by Mr. Price. Mr. Chamblin then quoted the figures prepared by the Society for Electrical Development which had appeared in the "Live Wire," the official announcer of the San Francisco Electrical Development League, to show the enormous business that is waiting for the electrical contractor and dealer if the architect and builder will cooperate with him.

That this cooperation be extended to include stores and industrial plants, was the suggestion of C. B. Kenney, San Francisco. Mr. Kenney pointed out that unless the plans and wiring diagram of a building were complete there could be no fair competition as each contractor would interpret the diagrams differently, and that in case of doubt he must necessarily add enough to the job to insure him making a fair profit. He suggested that a competent illuminating engineer lay out the plans for any large industrial installation and added that this would entail but little extra expense to the job and would insure a satisfied customer.

E. E. Brown, San Francisco, suggested that a committee from the contractor-dealers' association meet with the electrical and mechanical engineers to formulate a scheme whereby the wiring plans of all buildings would be added to the architect's drawings by a competent engineer. This committee could then meet with the architects and discuss this scheme, and Mr. Brown stated that this was a possible solution of the problem.

The practice of bidding low to get a job and then adding a lot of extras at an excessive profit to break even on the entire job was condemned by J. C. Hobrecht, Sacramento, who suggested more attention to detail in making up a bid and if extras were found necessary to add them at only a fair profit.

Mr. Romaine Myers, consulting engineer Oakland, then stated that in all of the cases that he had seen, there was only a difference of five per cent between the high and low bidder where the wiring diagrams had been properly laid out. In cases like this it is more satisfactory to all concerned, as the contractor knows how to bid and the owner knows what he is going to get and there are no extras.

The necessity of warning consumers against using all appliances on a lamp socket was suggested by Max Loewenthal of San Francisco, who stated that all appliances over 660 watts should have a special outlet.

The discussion on this paper was closed by Mr. T. M. Robinson, Robinson Electric Company, Fresno, who told of the city ordinances in that place relative to the wiring of stores and homes.

ADVERTISING

Captain Howard M. Angus, secretary of the California Electrical Cooperative Campaign, then read a paper on "Advertising" which he had prepared for the convention and which completely covered the field of advertising in which those present would be interested. This is one of the most complete papers ever presented on the problems that are peculiar to the advertising and merchandising of electrical goods.

Mr. Louis Levy, Levy Electric Company, San Francisco, recommended the more extensive use of bill boards and manufacturers' literature as a means of reaching the public, and stated that he believed that successful advertising was the result of repetition of the name of the firms to the public.

The necessity of advertising by the contractor was the message of M. T. Dolman, Pacific States Electric Company, San Francisco, who stated that by this means the architects and home builders could be educated to the idea of adequate wiring of homes and industrial plants.

"Service will hold consumers but more than that is necessary to get them," was the idea of G. E. Arbogast, Los Angeles, who said that while the older contractors were well known all over the state to the members of the industry, they were unknown to the public, and

for that reason, the contractors must advertise themselves.

Mr. Arbogast also spoke of the value of the convenience outlet campaign of the California Cooperative Campaign to the contractor and stated that the contractors should follow this up by intensive advertising. The industrial lighting exhibits that are to be installed by the Cooperative Campaign were explained and the contractor urged to use these to help him convert managers of industrial plants to better lighting.

Talks and lectures on the value of electricity for home use to be given to women's clubs and high school classes, were suggested by Max Lowenthal, as a means of getting close contact with the public and especially the coming generation of consumers.

VALUE OF APPLIANCE SOLICITORS

The discussion on the paper by A. W. Childs on "The Value of Appliance Solicitors" was started by G. E. Arbogast, who read excerpts from the original paper to establish certain facts and then gave figures based on his own experience.

He stated that the store was opened in 1914 and by 1918 the business had been built up so that $49,800 worth of goods had been sold over the counter. In 1919 the sales averaged the same as in 1918, or about $3500 per month until August. At this time the firm started an extensive advertising campaign and sent out solicitors, with the result that the sales averaged over $15,000 per month for the rest of the year. In the first five months of 1920 the firm had done a business that amounted to $67,833.60, and that they figured on a $200,000 business this year. This great increase in sales, Mr. Arbogast stated, was due to a large extent to the solicitors that had been sent out and who had covered the territory thoroughly not once but many times.

The fact that the majority of the dealers do not know how properly to finance themselves was brought out by Max Loewenthal, San Francisco, who dwelt at length on the dangers of allowing too many long-time-payment contracts to accumulate. The majority of people who buy the larger appliances do not need a long period of time in which to pay for them, and Mr. Loewenthal recommended that the customer be allowed six months to pay for the appliance except in special cases, and went on to say that this system of doing business would probably cause the dealer to lose a few customers but it would increase his financial standing because he would be doing business on a sound basis. The amount of money tied up in the larger appliances that are being sold on time payments, he stated, is a serious problem to the average dealer who has to borrow money from the banks to carry on his business while this money is outstanding.

A plea was made by G. E. Arbogast, Los Angeles, to keep the contracting and dealing business together and not try to run either as a separate business. In this way, he pointed out, a good live contracting business will furnish the capital to the merchandising side of the business which will enable it to carry notes on its larger appliances at a nominal rate of interest; consequently it will not be necessary to borrow money from the banks at the present rate of interest which is proving hard on some of the smaller dealers.

The idea that selling appliances on time was a banking proposition was brought out by H. W. Kimball, Oakland, who stated that the customer paid interest on the note in his payments on the appliance. He said that there had been some talk of starting an electrical bank to be supported by the industry, which would make a business of loans on time-payment contracts and would probably be of assistance to all branches of the industry.

VALUE OF PROPER ILLUMINATION

Extracts from the paper prepared by F. D. Fagan, Edison Lamp Works, San Francisco, R. E. Fisher, Pacific Gas and Electric Co., San Francisco, and H. W. Kimball, Oakland, on "The Value of Proper Illumination" for the last convention of the Pacific Coast Section of the N. E. L. A. were read by Mr. Kimball.

Discussion on this paper was started by Clark Baker, National Lamp Works, Oakland, who gave the results of a survey of lighting conditions in industrial plants that was conducted by the lamp manufacturers. This investigation was made by four specially trained men and included 440 plants investigated in 57 different towns in fifteen different states so that the results would be typical of conditions in the entire country. It was found that the average proportion of work done under artificial light in industrial plants was twenty-five per cent, according to the estimates of the executives interviewed, but this figure is believed to be low. In a chart showing where the manufacturer would seek advice regarding lighting changes it was shown that:

25%	would	ask	the	electrical retailer
21%	"	"	"	electrical jobber
13%	"	"	"	consulting engineer
9%	"	"	"	central station
32%	miscellaneous			

The total figures proved that 72% would go to the electrical distributor or to some one in their own organization. This would seem to indicate that the electrical jobber and retailer are the factors dominating the situation. The advantages of proper lighting were pointed out by Mr. Baker by the following table which is an appraisal by the manufacturers visited:

Increase in production	79.4%
Decrease in spoilage	71.1%
Prevention of accidents	59.5%
Improvement of discipline	51.2%
Improvement of hygienic conditions	41.4%

Another chart that proved of great interest was that showing where the lamps are bought, for it indicated to what extent the hardware dealer and jobber are cutting into the electrical industry:

Lamps	bought	from	the	manufacturer	8.2%
"	"	"	"	electrical jobber	43.4%
"	"	"	"	electrical retailer	34.6%
"	"	"	"	hardware jobber	3.6%
"	"	"	"	hardware retailer	2.6%
"	"	"	"	central station	18.2%
"	"	"	"	other dealers	1.7%

Ten minutes persuasion were necessary to tear Art Rowe away from his arduous task of entertaining the ladies.

Bill Shreve and Garnett Young, of San Francisco, looked in on the business meeting.

Earl Brown, San Francisco, and Mrs. Brown, trying to look sad in front of their new Oldsmobile.

Colonel Cass, Chico, upheld the honors of Northern California in the floating contest Friday afternoon.

Jim Crilly, Habirshaw Wire Co., was out to see that all of the rules of the game were observed by the winner of his cup.

Tom Bennett warming up for his "dollar-dollar-dollar" game with the financiers of the game. Tom has a stance like Babe Ruth.

Cap Kenney, San Francisco, cinched up his belt before taking his licks at Tom Bennett.

R. A. Balzari, Westinghouse, San Francisco, was in his usual happy mood. He usually uses two hands, though.

Mr. Baker closed by stating that there were in the city of Los Angeles 2700 industrial plants, in San Francisco 2352 industrial plants and in the state of California more than 15,000 plants. Of these at least 2700 need better lighting conditions and it is a wonderful opportunity for the electrical contractors of that state. There is a big business waiting for them and the lamp companies will furnish all of the data that the contractor needs to go after this business. Mr. Baker pointed out that ten states have instituted state lighting codes specifying the minimum amount of illumination allowed and recommending the maximum.

STANDARDIZATION OF WIRING METHODS

In reading excerpts from his paper on the "Standardization of Wiring Methods," H. H. Courtright, Fresno, dwelt on the desirability of having a single code or set of rules that would be enforced in all parts of the state so that the contractor bidding on a contract in San Francisco, Los Angeles, or Fresno could use the same type of construction in each case.

The reasons for the incorporation of the National Underwriters Electrical Code with the Electrical Utilization Safety Orders of the California Industrial Accident Commission were outlined by R. L. Eltringham, electrical engineer, California Industrial Accident Commission, who stated that a centralization of power was needed and that a committee of fifty men, representing all branches of the industry, had been appointed and had been working on the consolidation of these two codes for approximately a year. He concluded by saying that there was a real demand on the part of the majority of the industry for this work and that if certain factions decided to try and block this movement there would be a real fight.

BUSINESS MEETING

The business session was held Saturday morning and after the reading of the minutes of the executive session reports were made by the chairmen of the outstanding committees on the "Cost of Selling Motors" and "Sales Policy for Selling Motors." Nine new members were admitted to the association and Riverside was selected as the place for the 1921 convention. The monthly meetings will begin in August at San Diego, the September meeting will be held in Paso Robles and the October meeting in Bakersfield. A motion was made and carried that a committee of five be appointed from the association to meet with a like committee from the manufacturers and central stations for the purpose of considering the adoption of the dual code. A resolution was passed endorsing the work done by the California Industrial Accident Commission and pledging the unqualified support of the association to the dual code now being prepared. After a lengthy discussion during which Albert Elliot, counsel for the association, was frequently called upon for advice, the following motions were carried:

That the minutes of all meetings of all local associations be written up in duplicate, one copy of which shall be forwarded to the state secretary. This copy to be referred to the counsel of the association and in the event of the opinion of the counsel that any part of the proceedings prove illegal or against the spirit of the association, that part shall be rescinded at once. The other motion was that a committee of three members be appointed to draw up a uniform constitution and by-laws for the government of all of the local associations.

A committee of three was appointed to meet with electrical and mechanical engineers to form plans whereby architects and builders can be shown that it is to the advantage of their clients to have completely wired buildings.

ELECTION OF OFFICERS

The report of the nominating committee was then made and President Clyde L. Chamblin was nominated to retain the office of president for the coming year. He was unanimously re-elected by acclamation and in his speech of acceptance asked for the same whole-hearted cooperation that had been given him during the past year and which had enabled the association to proceed as a business organization along business lines. J. W. Redpath was unanimously re-elected as secretary and treasurer and the following executive committee was elected:

San Francisco—T. J. Bennett and E. E. Brown.
Oakland—R. V. Oyler and L. Spott.
Sacramento—J. Woods.
Northern California—W. H. Cass, Chico.
Stockton—R. Goold.
Sierra—C. E. Osborn, Turlock.
San Joaquin—H. H. Courtright.
San Mateo—M. E. Ryan, Redwood City.
San Jose—H. Guilbert.
Monterey—W. E. Cox, Santa Cruz.
Southern California—D. J. Butts, Los Angeles.
Long Beach—F. O. Lantz.
Orange Belt—E. J. Field, San Bernardino.
Orange County—J. Cope, Santa Ana.
Imperial Valley—Jerome Aiken.
San Diego—W. H. Cameron.

ENTERTAINMENT

On the night of the banquet the prizes were awarded to the successful contestants in the various sports. The surprise of the evening, however, was the awarding of a gold wrist watch to Mrs. Clyde

Chamblin, from the members of the association in appreciation of the work she had done as the wife of the president of association. The ladies' prizes were awarded by Mrs. Chamblin, Mrs. G. W. Foss of Sacramento receiving the first prize for the whist tournament and Mrs. W. Spencer of Oakland receiving the second prize. The ladies' swimming race was also won by Mrs. Spencer while the prize of a silver tray was awarded to Mr. and Mrs. A. L. Hughes, San Francisco, for the prize dancers. Two of the golf cups were won by Arthur Dahl, San Francisco,—the Crilley cup and the East Bay Electrical Trades Association cup for low net score. Sam Russell, San Francisco, won the cup offered by the state association for low net score by any one outside of the association. The attendance cup was won by the Sacramento local which was represented by seventy per cent of its membership, the presentation speech being made by Teddy de Pas, the "boy orator" of the San Francisco local, who promised the Sacramento local that the cup was only being loaned to them and would be returned to San Francisco at the next meeting.

ALBERT ELLIOT'S ADDRESS

One of the features of the banquet was the address given by Albert Elliot, counsel of the Association, who spoke on "A Few Fundamental Association Truths." Mr. Elliot said in part:

"The foundation of a business association rests upon simple and fundamental truths. The education of the members of such an association is the process of making each one see clearly these fundamental truths so that he will use them in his every day business life.

The motive of self-interest is the strongest possible motive which actuates us in business life. But self-interest should not be confounded with selfishness. There is a vast difference between these two words and the difference illustrates a part of the work which an association must do in an educational way. Selfishness is small, narrow, short visioned and ruinous, not only to the selfish person but to those also who are unfortunate enough to be his competitors. Self-interest is broad, deep and far visioned. The selfish man seeks some petty advantage today, even though it may result in disaster to himself and others tomorrow. He is his own worst enemy.

The self-interest man who is in business for the good of his family and himself sees very clearly that it is to his best interest to do all in his power to better the business conditions of his city and state. He works for the market of the future and not of the day. He sees clearly that it is good business for him to pull his competitor along with him in his progressive march. And thus the modern business man has resolved that his policy shall be to help his competitor where he can by the interchange of ideas. Through associations this work is furthered in the effort to dignify business methods, so that these shall result in enlightened activity in the place of blind staggering.

We thus see that we have tied together the strongest and finest of human motives, self-interest and mutual helpfulness. Once we can convince a man that his self-interest is along the line of helpfulness to his fellows, his conversion to the association idea is complete. We have full confidence in an association properly managed, because it stands for enlightened self-interest and therefore cooperation.

The man who consults his own enlightened self-interest, sees clearly the goal to which the real association is tending. The human element finally solves the business problem. Man must keep in business touch with man. Ideas are all in man, but they are only used when rubbed out of him by his associationship with his fellows. This is evidently the plan of the great Architect of the Universe. It does not matter what fine thoughts are in a man's soul if he never uses them. Association with fellow men makes us use the ideas. We pity the man who never learns from his fellows.

The function of an association is the bringing to the surface of the minds of business men the submerged ideas. You learn from your competitors in business when you associate with them. You need the association and the association needs you. You can help your competitors with profit to yourself. This is both good morals, good business and good sense."

Grover Anderson, EACO, San Francisco, didn't bite into a green olive—he simply made the last hole in ten.

George Curtiss, ERMSCO San Francisco, was smiling over his easy defeat of Paul Butte when he came into club house.

There wasn't really any ball there, but Garnett Young simply wanted to show how good his stance was.

The chairman of the entertainment committee certainly has a hard job at conventions, as is shown by the picture. Reading from left to right, Miss Wiseman, Mrs. E. A. Gearhart, Mrs. D. J. Butts, Mrs. T. J. Bennett, Mrs. Geo. Curtiss, Mrs. J. C. Hobrecht, Miss H. E. Marrow, Mrs. Romaine Myers, Mrs. Geo. Compton, Mrs. Clyde Chamblin, Mrs. C. B. Kenney.

"The early bird catches the worm." So Harry Garbutt (left) and Sam Russell (right) set out before lunch for the links, with the result that Sam won the prize. Harry lost his smile somewhere on the road but Sam still had his when he received the cup at the banquet.

Problem Course in Electricity

BY H. H. BLISS

(The elements of electricity as presented serially in the Journal of Electricity last year met with so much favorable attention that arrangements have been made with the author to follow up the series with another course laying special emphasis on practical problem work. The author is supervisor of the department of vocational education of Nevada.—The Editor.)

RELATIONS IN THE SIMPLE CIRCUIT

The Circuit.—From the meter cabinet, where the lighting circuit enters a residence, two wires run to any particular lamp. Close to the meter are to be found "fuses" through which the current goes to the wires leading to the lamp. If either fuse is "blown" (that is, if the metallic conductor within it is melted in two), it is impossible to light the lamp. This verifies the statement that there must be a complete conducting circuit to carry the current both to the apparatus and back to the source of energy.

Porcelain knobs and rubber coverings upon the two wires are used as "insulators" to prevent the escape of the current before it reaches the lamp.

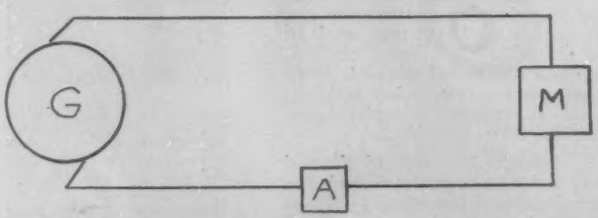


Figure A.—Showing a generator, on the left, connected through an ammeter with a motor, at the right.

If the insulation becomes injured, so that one bare wire touches the other, the current takes the "short circuit" and returns to the generator without passing through the lamp. In such a case the flow of electricity is usually so heavy that it blows one or both fuses, and thus it is automatically stopped. Fuses are installed for this purpose, because large currents in house wiring are apt to heat the wires to such an extent as to start a fire.

Connection Diagrams.—It is possible to indicate by means of a photograph how the current in any given circuit is carried from one piece of apparatus to another, but a more effective way is to use a simple wiring diagram such as Fig. A. This shows a generator (at the left) connected through an ammeter with a motor (at the right). Note the circle with two slanting marks, which is a conventional sign for a direct current generator, and the use of rectangles with initial letters to indicate motor and ammeter. The conductors are drawn as straight lines, though the actual wires may be very crooked.

Fig. B illustrates another circuit, containing a battery of four "cells," a voltmeter, an ammeter, a double pole single throw switch and a bell. As the switch is open, no current flows to the bell. (The two blades of the switch are connected at the top by a bar of insulating material, so that there is no short circuit there.)

Amperes and Ohms.—Various pieces of apparatus, including a lamp, a heater and a coil of wire, were connected in turn to the lighting circuit in a residence. By means of an ammeter in the line it was observed that the heater took a current of 5 amperes, the lamp ½ ampere, and the coil 8 amperes. Evidently the resistance each presented was different from that of the other two. In the lamp the number of "ohms" (the measure of resistance) was obviously greater than the number in the heater, for the lamp took far less current. The coil, on the other hand, took greater current, and hence had less ohms than the heater. **The greater the resistance, the less the current.**

Voltage.—When this heater was tested in another house, it was found to take 10 amperes, whereas it had formerly taken only five. Its resistance had not changed; hence it appeared that the **pressure** driving the current was greater. In fact, a voltmeter showed that the "electromotive force" (e.m.f.) was 220 volts in the second house and only 110 volts in the first. In a later test with a 22-volt storage battery the heater took only one ampere. The conclusion is that, with a given resistance, **the current is proportional to the pressure.**

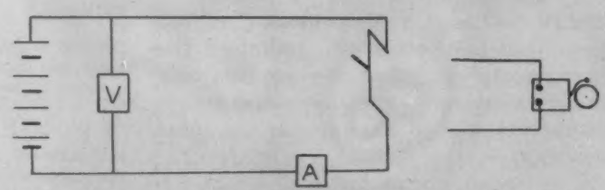


Figure B.—Diagram of a circuit which contains a battery of four "cells," an ammeter, a double pole single throw switch and a bell.

What, then, would be the current if this heater were connected to a 55-volt circuit? Since the voltage is ½ of 110, the current will be half as great as on the 110-volt circuit, or 2.5 amperes. Further, if we wished a current of 20 amperes, four times the current for 110 volts, we should have to apply 4×110, or 440 volts.

The Fundamental Law.—One volt is defined as the pressure needed to drive one ampere through one ohm. It follows logically that it takes 3 volts to drive one ampere through 3 ohms, and this is readily verified by experiment. Then to drive 2 amperes through 3 ohms requires twice as much pressure, or 6 volts. If the resistance were 7 ohms, it would take 7 volts for one ampere, and 28 volts for 4 amperes. In general, **number of volts = number of amperes × number of ohms.** This is Ohm's Law, and it is absolutely necessary to know it thoroughly. A student who gets it twisted (for instance, saying "Amperes = volts × ohms") not only fails to understand the logical relations of electrical quantities but also has endless difficulty in attempting to work practical problems. **Volts = amperes × ohms.**

Examples.—In a certain automobile a current of 5 amperes flows through an electromagnet. Its resistance is 1.2 ohms. What is the voltage of the storage battery which supplies the current? Solution: Voltage $= 5 \times 1.2 =$ **6 volts.**

What is the voltage of a "White Mazda" of 270 ohms resistance which is supposed to take .43 ampere? Solution: $.43 \times 270 =$ **116 volts.**

To Calculate the Current.—How many amperes flow through a 4-ohm coil connected to a 12-volt starting and lighting battery? By Ohm's Law, 12 = amperes $\times$ 4. Obviously the answer is **3 amperes,** obtained by a process of division. **Amperes = volts ÷ ohms.** This is another aspect of the fundamental law, and it also should be memorized as a formula.

What current is taken by a 24-ohm heater on a 108-volt circuit? Solution: $108/24 =$ **4.5 amperes.**

A certain telegraph sounder has 50 ohms resistance. What current flows if it is connected to a dry battery (1.5 volts)? $1.5/50 =$ **.03 amperes.**

Figuring Resistance.—The most common method of finding the number of ohms in a piece of electrical apparatus is to connect it to a circuit of known voltage and measure the current it takes. For example, the pair of wires leading from a telephone station to a private branch exchange are "shorted" or connected together at the far end, and attached to the 24-volt central battery at the station. What is the resistance of the line if the ammeter reads 2 amperes? Here $24 = 2 \times$ ohms, or the ohms $= 24 \div 2 = 12$. Thus we have the third aspect of the law: **Ohms = volts ÷ amperes,** or **resistance = electromotive force ÷ current.**

To drive 250 amperes through a certain copper bar takes only .4 volt pressure. What is its resistance? $.4/250 =$ **.0016 ohm.**

Problems

1. What is the voltage of the battery sending 1.8 amperes through a house bell of 2.5 ohms resistance?

2. When 380 volts pressure is applied to a certain controller, a current of 69 amperes flows. What is the resistance of the controller?

3. How many ohms are there in a piece of German silver wire through which a 2-volt battery sends .155 ampere?

4. The field circuit of a certain generator has 48 ohms resistance. Calculate the current when 120 volts are applied.

5. A workman accidentally dropped his pliers upon the wires leading from an electroplating generator. The resistance of the short circuit was .074 ohm. What was the voltage of the generator if the current which flowed through the pliers was 46 amperes?

6. The resistance of a telegraph circuit was 2100 ohms. Calculate the current when a voltage of 81 was used in signaling.

7. What is the resistance of a 220-volt carbon lamp which takes a current of .27 ampere?

8. A current of .92 ampere was sent through a long glass tube full of mercury, the metal having a resistance of 3.3 ohms. What was the electromotive force?

9. When 4.1 volts were applied to the armature of a 10 horsepower motor, the current was found to be 58.5 amperes. Calculate the armature resistance.

10. To test the effect of change of temperature, a coil of copper wire was cooled to freezing with ice and then heated to the boiling point of water. A 6-volt storage battery was connected to the coil all the time. The current was observed to drop from 1.2 amperes to .86 ampere as the wire was warmed. What was the resistance in each case?

The Reinforced Concrete Arch Dam

BY F. A. NOETZLI

(Foreign practice in the designing and building of dams has a continual, inherent interest, but for the West, where electrical development depends so largely on water power, this branch of engineering is of especial importance. The following article gives technical details of a recently constructed dam in Sweden. The author is engineer with the Beckman & Linden Company. —The Editor.)

Although a great number of arch dams of reduced gravity section have been built successfully in the United States, very few dams of this type have been constructed as yet in Europe. Notwithstanding the early and well-known example of the Zola Dam in France, it was only recently that the desire or the compelling necessity for increased economy brought the slender arch dam into more general favor.

An arch dam of fairly slender cross section was recently completed in Sweden,* to divert the waters of the Gide river for a hydroelectric power development. The dam has a maximum height of about 58 feet and is 140 feet long at the crest. The thickness at the bottom is 17.7 feet and at the top 6.5 feet. The radius of the centerline of the arches varies from R = 63 feet at the bottom to R = 95 feet at the crest, thus allowing a considerable saving in dam material. The dam body is heavily reinforced for temperature and shrinkage stresses.

Along the crest there are a series of movable gates, whereby the water level is raised for an additional 11.5 feet. In case of floods these gates are opened and the dam will be over-topped by about 12 feet of water.

*See: Bo Hellstrom, Teknisk Tidskrift, No. 3, 1919.

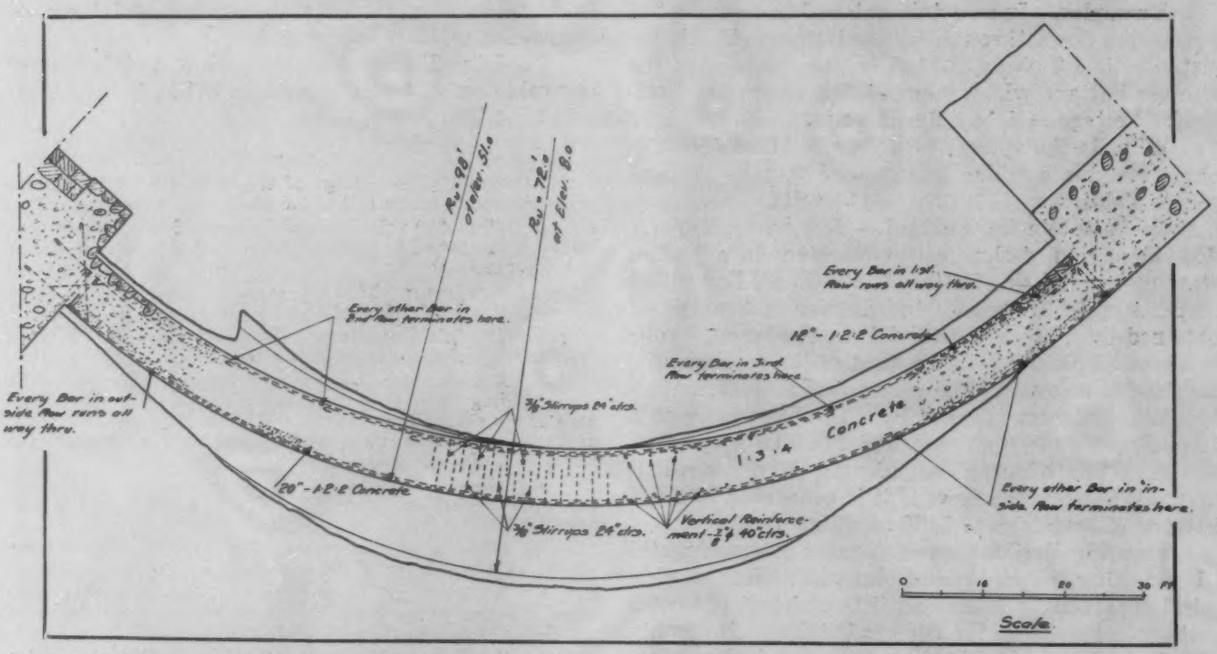
Theory of Construction —

The design of this dam was based upon the usual assumption that all the water pressure be supported by horizontal arching. The vertical cantilever action which necessarily has to occur even in dams of slender cross section was simply assumed as increasing the safety of the structure to an unknown degree.

On the other hand, the stresses in the horizontal arches were determined in a similar way as for concrete arches for bridges. Therefore not only the direct stresses due to the water and ice pressure were considered, but also the stresses from shrinkage in the concrete and those due to changes in the temperature of the arches.

Temperature Consideration —

For the purpose of design it was assumed that the shrinkage of the concrete was equivalent to a decrease in temperature of 18 degrees Fahr. in the upper portion of the dam, and 9 degrees Fahr. in the


R = 98' at Elev. 510
R = 72' at Elev. 810
Every other Bar in 2nd Row terminates here.
Every Bar in outside Row runs all way thru.
Every Bar in 1st Row runs all way thru.
12'-1:2:4 Concrete
Every Bar in 3rd Row terminates here.
3/4" Stirrups 24" ctrs.
Concrete
1:3:4
20'-1:2:4 Concrete
3/4" Stirrups 24" ctrs.
Vertical Reinforcement - 3/4" @ 40" ctrs.
Every other Bar in "inside Row terminates here.
0 10 20 30 Ft
Scale

Cross section of concrete arch dam, showing special features of reinforcement to withstand temperature changes and excessive tensile stresses.

lower portion. The seasonal changes in the temperature of the arches were assumed as a linear function of the combined action of the changes of water and mean air temperature. The maximum range of arch temperature considered was the variation of + 27 degrees Fahr. in summer to — 31 degrees Fahr. in very cold winters, measured from the pouring temperature of the concrete.

By considering the horizontal arches as hinged at the side abutments, the stresses in the arches were obtained to somewhat over 850 lbs. per sq. in. in the concrete and about 25,000 lbs. per sq. in. in the steel.

This example of arch dams presents two most striking features: first, the heavy reinforcement of the horizontal arches from the crest of the dam to little above the foundation, and second, the high unit stresses occurring under the assumptions made.

As stated previously, the design of this dam was made with due consideration of temperature and shrinkage deformations, which, as is well known, occur to a very marked degree in all concrete arch dams as shown by the occasional occurrence of vertical cracks during winters. It is a question still in dispute how much the mean temperature of a slender arch dam varies during a year, and the measuring of temperature changes in dams already built is most desirable. In the case of this dam the designer probably had good reasons for assuming the rather high variation of 58 degrees Fahr. Enough steel was placed in the zones of tension to take care of the occurring tensile stresses. The allowed stresses of 25,000 lbs. per sq. in. in the steel and 850 lbs. per sq. in. in the concrete are rather high, though perhaps not excessive in this case in view of the extreme variation of temperature considered.

Future Dam Construction —

Very few of our California arch dams have been reinforced according to scientific methods as used, for instance, in the design of arch bridges. As a consequence many of these dams have seriously cracked under excessive tension stresses, so that, when the arch comes under pressure, the compression forces are transmitted across rough broken surfaces. In time this may lead to serious injury to the two surfaces of each crack and to gradual deterioration of the adjacent concrete. It will therefore be most desirable for future designs of arch dams to pay more attention also to the stresses resulting from temperature and shrinkage deformations.

CANADA'S ELECTRICAL-APPARATUS INDUSTRY

Figures of the industrial census taken by the Canadian Bureau of Statistics in 1918 are being made public as the compilations for the different industries are completed. One of the bureau's most recent bulletins deals with the manufacture of electrical apparatus within the Dominion. The returns show a total of 68 plants engaged in the manufacture of electrical goods of various kinds, 42 of them being located in Ontario, 13 in Quebec, 7 in Manitoba, 3 in British Columbia, 2 in Alberta, and 1 in Saskatchewan. These 68 plants represent a total capital investment of $43,285,405—Ontario leading with $26,426,129, Quebec following with $16,525,454, Manitoba being credited with $253,026, British Columbia with $42,-881, Alberta with $19,736, and Saskatchewan with $18,179. Of the total capital $10,636,572 was invested in land, buildings, and fixtures, $6,518,132 in machinery and tools, $17,071,528 in materials, stocks in process, finished products, fuel, and miscellaneous supplies on hand, and $9,059,173 represented working capital. In 1918 the industry had 6,595 male and 2,268 female employes, to whom it paid $8,456,705 in salaries and wages.

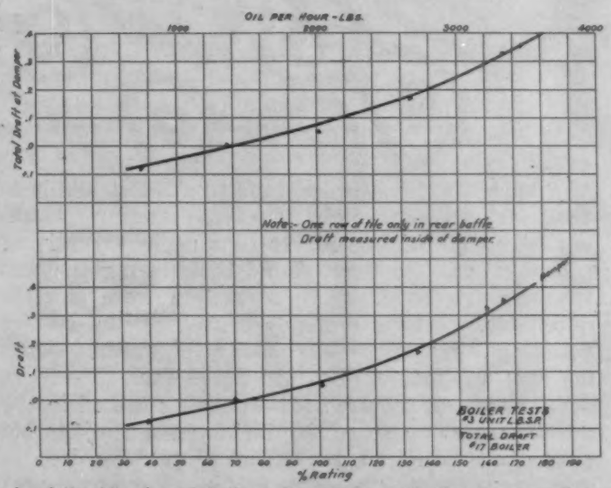
Steam Power Plant Tests—I.

BY H. L. DOOLITTLE

(Tests made in steam electric plants are of the highest importance in connection with the efficient operation so necessary for the conservation of fuel oil at this time. Following is the first instalment of interesting data on tests made in a large Western plant. The author is steam power plant specialist with the Southern California Edison Company.—The Editor.)

The following report covers a series of tests conducted on the boilers at the Long Beach steam plant of the Southern California Edison Company. These tests extended over a period of approximately ten months.

The Long Beach steam plant is located at the


Oil per Hour-Lbs.
Total Draft at Damper
Note:- One row of tile only in rear baffle
Draft measured inside of damper
Draft
BOILER TESTS #3 UNIT L.B.S.P.
TOTAL DRAFT #17 BOILER
% Rating

A relationship of total draft at the ammeter with the oil consumed per hour; compared also with the percentage of rating at which the boiler is operated. Note that the draft is made inside of the damper.

Long Beach inner harbor, Long Beach, California, and consists of the following equipment:

No. 1 Unit—placed in operation August 20, 1911, consisting of: 1—12,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—777.5-hp. Stirling boilers; duplex feed pumps; turbine-driven exciter; engine-driven centrifugal circulating pump. All auxiliaries steam-driven excepting spare hot well and oil drain pumps which are motor-driven.

No. 2 Unit—placed in operation February 2, 1913, consisting of: 1—15,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—777.5-hp. Stirling boilers; steam-turbine-driven centrifugal feed pumps; turbine-driven exciter; steam-turbine-driven centrifugal circulating pump. All auxiliaries steam-driven excepting spare hot well and oil drain pumps which are motor-driven.

No. 3 Unit—placed in operation March 30, 1914, consisting of: 1—20,000-kw. General Electric Company vertical Curtis turbo-generator running at 750 r.p.m.; 8—850-hp. Stirling boilers fitted with Sturtevant economizers; motor-driven exciter; centrifugal boiler feed pumps; centrifugal circulating pump. Auxiliaries motor-driven with the exception of the fuel oil pumps which are duplex steam pumps.

All boilers are equipped with four Hammel oil burners and B. & W. U tube superheaters.

All units operate at the normal pressure of 225 gauge and 125° F. superheat.

Method of Testing —

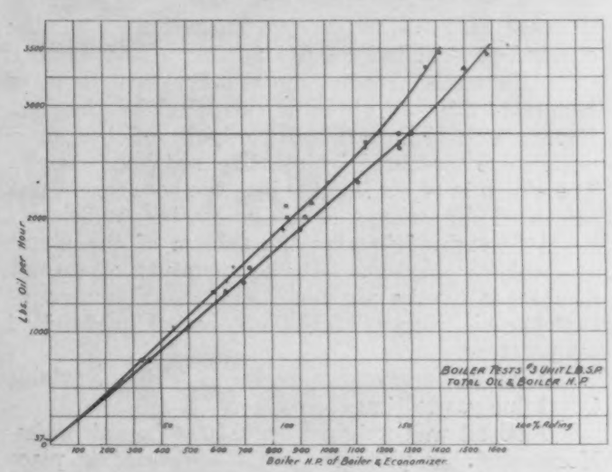
In general all tests extended over a period of from seven to eight hours, all observations being taken every fifteen minutes. Such observations as weighing of oil and water and the measurement of kilowatt-hours were balanced every hour. It was necessary for every observer to make a dozen or more different observations but as these observations were always made in the same order, it resulted in obtaining readings which were always practically fifteen minutes apart.

All temperatures, except the stack temperatures, were taken with mercurial thermometers calibrated by means of a standard thermometer.

All pressure gauges were calibrated with the dead weight gauge meter. Small differences in pressure and small pressures were measured with mercury U tubes.

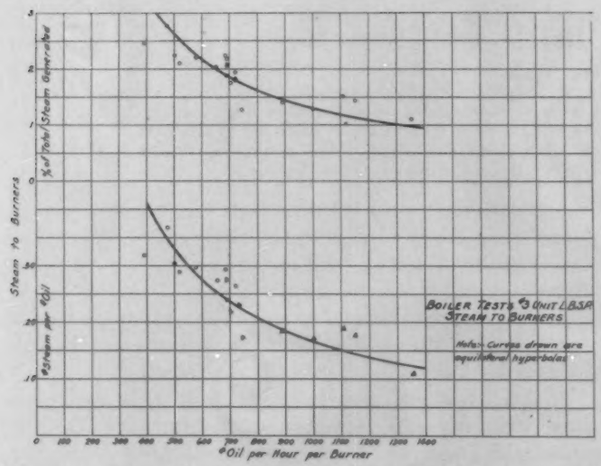
The vacuum in the condensers was measured by means of absolute pressure gauges, thus eliminating the effect of varying barometer.

Stack temperatures for boiler tests were measured by means of a resistance thermometer consisting of copper wire installed in the path of the flue gases. The resistance of this wire was obtained by taking a cold reading after the wire was installed. Temperatures were calculated from the variation in the resistance of the wire. It was hoped that this method of measuring the flue gas temperature would

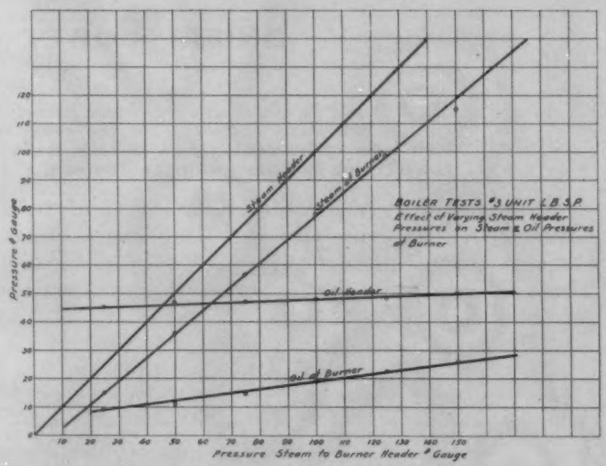


The pounds of oil per hour shown in relationship with boiler hp. of boiler and economizer combined.

be very accurate inasmuch as the wire was strung back and forth across the flue so as to measure the average gas temperature. It was found, however, that this method of measurement gave more or less erratic results which must be due to the varying velocities of the gas flowing past the wire. It appears that in general this method would give results that are too low, on account of the fact that the gas in the upper part of the flue is the hottest and travels with the greatest velocity. It is, however, believed that this method gives as accurate results as can be obtained by means of a thermometer or a pyrometer as either of these methods would be subject to the same error due to varying gas velocities. The ideal method of measuring gas temperatures


Steam to Burners
Oil per Hour per Burner
Boiler Tests #3 Unit L.B.S.P.
Steam to Burners
Helix Curves drawn are equilateral hyperbolas

Steam to burners utilized in furnace operation shown in relationship with the oil per hour per burner. Note the interesting result obtained is that the curves are thus shown to be equilateral hyperbolas.


Steam Header
Steam at Burners
Oil Header
Oil at Burner
Boiler Tests #3 Unit L.B.S.P.
Effect of Varying Steam Header Pressures on Steam & Oil Pressures at Burner
Pressure Steam to Burner Header # Gauge

A relationship showing the effect of varying the steam header pressure with the steam and oil pressures at the burner.

appears to be some system by which the product of the velocity of the gas by its temperature, could be averaged for various sections of the flue.

The stack temperatures for the plant tests were obtained by means of a resistance thermometer consisting of a small coil of copper wire placed on the end of a piece of iron pipe. This resistance thermometer was used to take readings at different points across a horizontal section of the stack located at approximately the roof line.

The readings of the resistance of the coil were checked at least twice a day against a cold reading.

All electrical readings were taken with standard test meters by an observer furnished by the Test Department. Kilowatt-hour outputs of the main units were measured by rotative watthour meters. The amounts of air leakage into the condensers was measured by means of a gasometer sufficiently counter-weighted to give the volume of the air at atmospheric pressure. The temperature of the air discharged by the air pump was also measured so that the air leakage could be corrected to standard temperature.

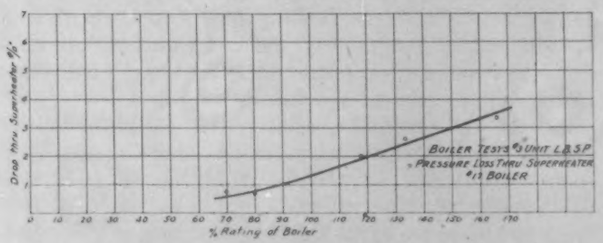
Flue gas analyses were made with a portable Orsat flue gas testing apparatus.

Fuel oil was weighed on a 5000-lb. Fairbanks-Morse portable platform scale calibrated in place against standard weights.

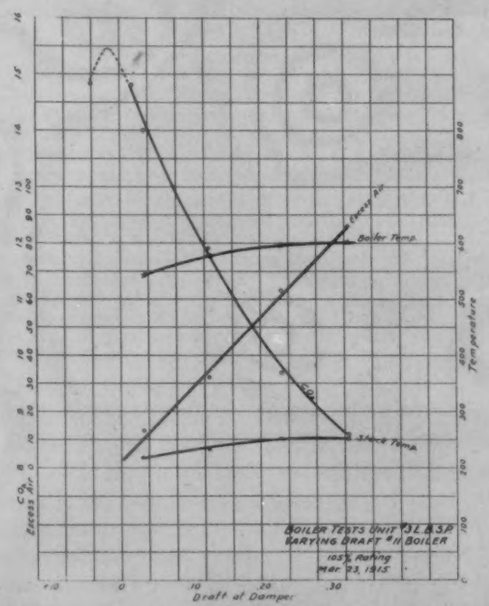
Condensate from the No. 3 turbine and total water fed to boilers for the No. 1 and No. 2 unit tests were weighed on two 15-ton platform scales weighing to five lbs. Condensate from the No. 1 and No. 2 units was measured by Worthington water weighers. These weighers operate on the principle of a bucket automatically dumped after it has been filled with a given weight of water. They were calibrated by measuring several dumps in a receiving tank. It was, however, found that during the test the readings given by these meters were entirely unreliable. This is probably caused by the meters dumping a greater or less amount of water depending upon the rate of flow into the meter.

The steam required for atomizing the oil in the burners was measured by installing an orifice between two flanges in the steam pipe. The drop in pressure through this orifice was measured by means of a mercury U tube. The orifice was calibrated by condensing the steam flow through the orifice during a given period of time in a tank of water and measuring the increase in weight.

In the No. 3 unit it was necessary to raise the temperature of the condensate going to the economizers to approximately 100° in order to prevent "sweating" of the economizer tubes. This heating was



Pressure loss through the superheater in its relationship with the rating of the boiler.



A relationship showing the varying draft of a boiler when operated at 105% rating in its relationship with draft at the damper and the temperatures of the stack.

done by means of live steam introduced into the suction pipe of the feed pump. The temperature and pressure of this live steam was observed and the amount of steam used calculated by means of the temperature rise of the feed water.

Four samples of oil were taken. These samples were composed of small amounts of oil taken approximately every hour from the oil being fed to the boilers. The analyses of the oil samples were made by Wrana King & Company, chemists, Los Angeles.

The water evaporated during the boiler tests was obtained by correcting the total water weighed to the boilers for feed pump leakage, amounting to 75 lbs. per hour. In all tests the water evaporated was corrected for the height of the water in the boiler gauge glasses, the deduction amounting to 670 lbs. per inch.

In addition to weighing the total feed to the boilers, this feed was also measured by means of Venturi meters which are permanently installed in the feed lines. Circulating water to the condensers was measured by means of a Venturi meter for the No. 3 unit, and General Electric Company water flow meters for No. 1 and No. 2 units.

Total steam generated was measured by General Electric Company steam flow meters permanently installed in the main steam headers in addition to the calculation made from total water fed to boilers.

A series of nineteen boiler tests was conducted on the boilers of the No. 3 unit in order to determine the most economical load at which the boilers should be operated. In the test on a single boiler, one boiler of a battery was used with the other boiler of the battery shut down. This necessarily increased the radiation losses of the boiler being tested but it was much easier to conduct the test in this manner on account of the fact that one economizer is installed to take care of two boilers. The tests made on two boilers were made with both boilers in one battery operating.

In all of the boiler tests complete readings of the temperatures, pressures and water fed to the boilers were taken so as to determine the efficiency of the boiler alone and also the combined efficiency of the boiler and economizers. All of the boiler tests, excepting that made on 3/9/15, were made with Hammel oil burners.

The first ten tests were conducted on the boiler with the furnace as originally installed by the manufacturer. The remaining tests were made on a boiler with the furnace rebuilt to accommodate three instead of four burners. In addition to rebuilding the furnace, the boiler for the last series of tests had a slight modification in the baffling of the rear pass. This modification consisted in removing two rows of 12-in. tile directly in front of the damper opening.

In this series of boiler tests we endeavored to determine the efficiency of both the boiler and economizer at different loads, the maximum and minimum loads that the boiler was capable of carrying, the effect of hot water entering the economizer, the efficiency of the boiler during a swinging load, and also the oil required to bring the boiler up to header pressure after being shut down for several hours.

ILLUMINATION IN A STOCK SHOW BUILDING

BY F. D. WEBER

(The proper lighting of public buildings, fair grounds, and so forth, is a study in itself, and is determined by various factors of efficiency, safety and effectiveness. Following is an account of the lighting arrangements in a large stock-show building in the Northwest, by the electrical engineer for the Oregon Fire Insurance Rating Bureau.—The Editor.)

The ninth annual stock show of the Pacific International Live Stock Exposition which took place some time ago in Portland, was held in the largest stock-show building exclusively devoted to such purposes in the world. The big pavilion covers 7½ acres of a 15-acre tract, leaving 7½ acres for roadways, automobile parking space and ornamental strips.

The central feature of the stock-show building is a huge stadium of red brick and ivory-toned stone, having a massive portico with eight columns and a

The main arena of the stock-show building, with a seating capacity which can be made to accommodate 10,000 persons.

huge glass dome. This big stadium is flanked by two great wings of heavy timber construction, the color scheme of red and ivory being carried out in these extensions.

Just under the great central dome the interior feature is a great pavilion 200 feet wide by 200 feet long, in which seats have been provided for 8,000 people, with a 100 by 200-foot arena in the center.

Flanking the main arena on either side there are two other arenas, each capable of seating 1,000 people and with a spacious sales ring in the center.

In the big horse barn at the rear of the main stadium there are stalls for 500 horses; there is a sheep section which will take care of 4000 animals and swine sections that will comfortably house an equal number.

An abundant supply of running water, both hot and cold, is provided in all parts of the building, so that the animals may be kept in show condition and ready for exhibition at any time. Special consideration has been given to sanitation arrangements and scientific ventilation. The lighting problem has been solved by a series of slanting roof sections, with glass inserts. Spacious offices and rest rooms have been provided near the entrance of the building.

In the main arena all electric wiring is in rigid iron conduit, and the balance is of the "knob and tube" type of construction.

Power (single phase, 3-wire, 110-220-volt), is furnished by the Portland Railway, Light and Power

Company. A transformer vault is located just outside the building in the ground. Service is brought into a main line cabinet, and a switch located under one tier of seats of the main arena. The service consists of three 600,000 cir. mil. rubber covered cables. From the main distribution center sub-feeders are run to various cabinets located in the pavilions.

The main arena is illuminated by 45 Benjamin 500-watt fluted bowl reflectors, while in the sections over the boxes and seats, Benjamin shallow bowl reflectors are used. The above lights are installed on 50 separate circuits served from two cabinets containing 14 and 36 circuits respectively.

On the dome of the building there is installed one 500-watt and one 200-watt lamp, and in the entrance there are four large bronze fixtures containing 100-watt lamps. Also in the face of the building, worked in with the architecture, are installed 36 flush receptacles.

The building, exclusive of the main arena, is divided into pavilions, A, B, C, D and E. In pavilion A and E, where the cattle stalls are located, there are 6 circuits and 35 100-watt lights equipped with Benjamin reflectors. In pavilion B (hog pens), there are 4 circuits and 16 100-watt lights equipped with the same type of reflector as in pavilion A. Pavilion C has 10 circuits—4 300-watt lights and 10 100-watt lights equipped with Benjamin reflectors, also 32 60-watt lights in Benjamin deep bowl reflectors over wash racks, passageway, etc. In pavilion D are the sheep pens, with electrical equipment the same as in pavilion B.

All of the electrical equipment was installed by the National Electric Company of Portland, Oregon.

Steam Turbine Characteristics

BY WILLIS T. BATCHELLER

(The causes of losses in steam turbines are among the operating characteristics with which all engineers must be familiar. A brief and helpful summary of these is here given by the electrical engineer of the Seattle Lighting Department, in the fifth of a series of articles on steam turbines.—The Editor.)

LOSSES IN STEAM TURBINES

Steam turbine losses may be divided into five classes.

Friction

Losses due to friction occur in the nozzles or stationary blades and in the rotor vanes. They are proportional to the exposed area and the square of the velocity. They have the effect of reducing the velocity of the steam and increasing the heat content.

Eddies

Shocks, eddies and vibration cause losses, especially at partial admission.

Clearance

In impulse turbines clearance losses occur between the shaft and diaphragm carrying the guide blades. In reaction turbines they occur in the space between the rotor vanes and the casing. This leakage steam supplies heat to the working steam, making it drier.

Windage

This loss is due to the rotation of the moving blades in the casing. In reaction turbines all the vane spaces in the guide vanes and rotor wheels are filled with steam and friction losses are small. Windage is proportional to the square of the diameter or to the wheel surface.

Radiation

As radiation losses are proportional to the difference of temperature between the turbine and the surrounding air, they are greater in the high pressure part of the turbine where the temperature is higher.

Centrifugal Force on Water

Water in damp steam, set in motion by centrifugal force, causes a loss of energy. This can be partially overcome by efficient drainage of the working chamber.

Exhaust

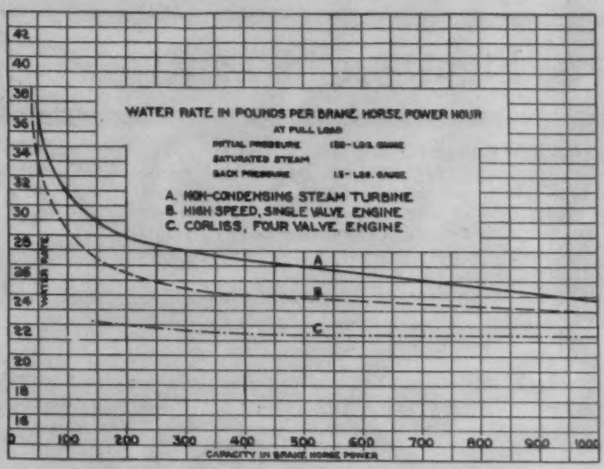
Steam on leaving the turbine still possesses a certain velocity and is capable of doing an amount of useful work equal to the velocity squared divided by two times g per pound of steam.

Economy

On account of the wide variation in operating conditions encountered, the comparison of the water rates of reciprocating engines and steam turbines must necessarily be limited to some given set of conditions and to full load economies. In the case of non-condensing units and in the smaller sizes the reciprocating engine is more economical. With high pressure, high vacuum condensing units, the steam turbine economy is better. However, the small steam turbine has become standard for many purposes, especially in large plants, on account of its numerous advantages aside from the water rate. The accompanying curves show the comparison in steam economy between the average non-condensing engines and steam turbines and also between condensing engines and steam turbines. They show that the non-condensing high speed engine has a slight advantage. On the other hand the condensing steam turbine is more efficient than the compound, condensing steam engine in sizes of one thousand horsepower and larger. The curves must necessarily show average results for the steam conditions given, and special cases will vary from the values indicated.

Applications

The most extensive use made of large steam turbines is to drive electric generators to which they are directly connected. Individual electric motors for driving the various pieces of machinery in mines, saw mills and industrial plants of all kinds, make the ideal system from the standpoint of flexibility and economy, and are often made possible by the installation of a steam turbine driven generator. Steam


WATER RATE IN POUNDS PER BRAKE HORSE POWER HOUR
AT FULL LOAD
INITIAL PRESSURE 150-LBS. GAUGE
SATURATED STEAM
BACK PRESSURE 15-LBS. GAUGE
A. NON-CONDENSING STEAM TURBINE
B. HIGH SPEED, SINGLE VALVE ENGINE
C. CORLISS, FOUR VALVE ENGINE
WATER RATE
CAPACITY IN BRAKE HORSE POWER

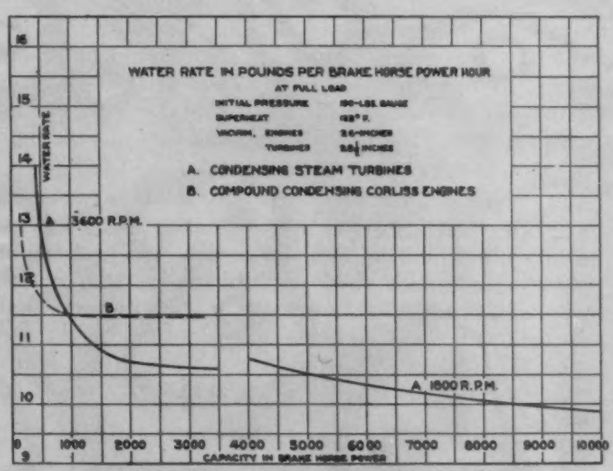
Curves showing comparison in steam economy between the average non-condensing engines and steam turbines. The non-condensing high speed engine has a slight advantage.

turbines for ship propulsion are rapidly superseding marine reciprocating engines, particularly in the larger sizes.

Small steam turbines are used under the same conditions as electric motors, for driving fans, blowers, pumps, generators, etc.

Advantages

The principal advantages of the steam turbine are low first cost, low maintenance and operation



Curve showing comparison in steam economy between condensing engines and steam turbines. The condensing steam turbine is more efficient than the compound condensing steam engine in sizes of 1000 hp. and larger.

costs, economy of space and foundation, freedom from vibration, uniform angular velocity, absence of oil in condensed steam, and high efficiencies for large variations in load.

The author wishes to acknowledge the use of material obtained from Gebhart's Steam Power Plant Engineering, Thomas' Steam Turbines, Leland's Steam Turbines, Marks' Handbook, and information obtained directly from the turbine manufacturers.

Western Ideas

STICKERS clipped onto the posters which are sent to electrical dealers do a great deal to insure the posters being put up directly in the window or in some other part of the store. When the average dealer receives a poster, he finds nothing handy with which to put it up, and so usually puts it away for possible future use. The result is that it is allowed to lie around until it finally becomes old and dingy and is thrown into the waste basket.

Use these Stickers to Put the Poster in Your Window It Brings Business

The stickers which are attached to posters to insure their being put up in the display window without delay.

A certain Western supply house attaches the stickers shown here to every poster they send out so that the slip of paper will remind the dealer that it is valuable to his business to have the poster in his store and at the same time will offer him a practical means of sticking it up.

IF YOU ARE MOVING don't lose perfectly good advertising time and opportunity by allowing your window to stand vacant during the ten or twelve moving days. The Lewis Electric Company of Modesto, California, which moved recently into the new shop shown in the picture below, arranged their window display before any other part of the store so that those who passed by became acquainted with the store before its doors were actually open for business. In this way moving from one shop to another does not mean even a temporary loss of business. It can, on the other hand, be carried out as an excellent advertising program, so that increased trade is found waiting for the doors to open.

A picture of the new home of the Lewis Electric Company, Modesto, California, showing the display windows which, for advertising purposes, were arranged before any other part of the shop.

COMING CONVENTIONS

American Institute of Electrical Engineers — — Portland, Oregon, July 21-24

American Society of Civil Engineers — — Portland, Oregon, August 10-11

Northwest Electric Light and Power Association— — Spokane, Washington, September 15-18

SPARKS—Current Facts, Figures and Fancy

(On this page you can learn how much business an all-day sucker factory can do per day; why March 4th is inauguration day; what electricity can do to purify milk and to aid the music teacher and what is being planned to develop hydroelectric power in the Holy Land. The last words on the subject of movie theatres and the manufacture of women's clothing are also set forth along with facts concerning the production of oil in California and the present day currency of Poland.—The Editor)

There are now three automobiles to every railroad freight car.

* * *

In England the names of towns are painted on the roofs of the railroad stations to guide airmen.

* * *

Light travels at the rate of 186,400 miles a second, electricity at the rate of 248,500 miles a second.

* * *

An all-day sucker factory in the middle west does $10,000 worth of business a day, making an article which retails for one cent.

* * *

Seattle is building the largest commercial pier in the world. It is 2,560 feet long and 360 feet wide and will be able to dock eleven ocean-going vessels at one time.

* * *

The total amount of the domestic exports of typewriter ribbons from the United States during 1919 amounted to $808,259. France and Argentina took the largest shipments.

* * *

March 4th, the date fixed for the inauguration of Presidents of the United States, was selected because Sunday seldom falls on this date—only three times during the present century, 1917, 1945, 1973.

* * *

Potatoes are now being used as the standard currency in certain remote agricultural districts of Poland. It has been found that the value of the potato fluctuates far less than any of the various types of paper money which are in circulation.

* * *

A certain new device makes it possible for the vocalist to hear the effect of his own voice the same as it sounds in the auditorium. A transmitter having a battery in its body is strapped on the chest and from this, cords lead to a telephone head-band.

* * *

The last word in picture theatre construction is nothing less than a sound-proof, glass-enclosed room for mothers who have crying babies. In this room, which is in full view of the stage, mothers may congregate and enjoy the show even though the youngsters cry in infantile chorus.

* * *

A most attractive illuminated aquarium is the result of a glass container with a suitably mounted incandescent light in the bottom. No gravel is used, plants being attached to miniature turtles and rocks. The light shining through the glass on the fishes and vegetation gives a most pleasing effect.

* * *

The Swedish parliament has definitely approved of the electrification of the state railways between Stockholm and Goteborg and has appropriated for the work 23,000,000 crowns (normally $6,164,000). It is expected that the conversion from steam to electrical operation will be completed by 1925.

* * *

Women's clothing prices are sky-rocketing so in London that the Government is planning to supervise the manufacture of half a million standard costumes and coat frocks. Paris is also putting out "national" ready-made clothing at the rate of 25,000 suits monthly at 110 francs a suit. The clothing house prices are up to 250 francs.

* * *

Figures show that the cost of the power house repair work has been considerably increased during the past five years. The cost of rewinding a 25-hp. armature has increased from $75 to $160, the cost of removing a crosshead for a horizontal engine has increased from $180 to $430, and the cost of renewing a valve spindle has increased from $25 to $81.25.

* * *

An electrically operated embroidery machine recently on exhibition in a large western department store, is equipped to do embroidery in silk, metal, wool and braid. This works with such rapidity that designs which, if done by hand, would take three months, are easily finished in two hours' time. Many patterns are possible also which cannot be worked by hand.

* * *

The production of oil in the California fields during 1919 increased 1,517,690 barrels, or 1½% over the output of the previous year. The outstanding feature of California oil production is its fairly constant rate for several years. Such a condition may be expected to continue for several years, and shortage of oil or its products, will be due to increased consumption.

* * *

Milk can be freed from a pathogenic bacteria through a recently discovered electrical process. Under this treatment the temperature of the milk is not raised higher than 64 degrees C. yet the percentage of bacteria reduction is 99.93. The keeping power of the milk is considerably increased, the taste is not altered, and so far as chemical examination can determine, the properties of the milk are not in any way impaired.

PERSONALS

S. H. Taylor, general manager of the Electric Railway and Manufacturers' Supply Company, has been appointed secretary of the Pacific Coast Section of the National Electric Light Association by President L. H. Newbert. Mr. Taylor has long been associated with the commercial side of the electrical industry on the Pacific Coast as he has been connected with the Electric Railway and Manufacturers Supply Co. since the time it was founded in 1892. Mr. Taylor takes the place of **Arthur H. Halloran,** Pacific Coast representative of the McGraw-Hill Book Company, who has been secretary of the Pacific Coast Section, N. E. L. A., since the formation of that section. Mr. Halloran was forced to resign his position as secretary due to the increased necessity for more concentrated attention to the growing book sales of the company and production of new books.

C. F. Henderson has recently been appointed California agent for the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio.

C. P. Bowie, petroleum engineer, U. S. Bureau of Mines, has returned to San Francisco from a trip through the southern California oil fields.

E. A. Wagner, engineer for the transformer department in the Fort Wayne works of the General Electric Company, is a recent visitor in Los Angeles.

T. E. Swigart, petroleum technologist, of the Bartlesville station of the U. S. Bureau of Mines, spent two weeks during June at the San Francisco office of the Bureau.

G. E. Armstrong, associate editor of the Journal of Electricity has left for New York where he will spend several weeks in the New York offices of the McGraw-Hill Company.

David Perry, formerly specialty salesman for the E. M. M. Service Company in Lindsay, has joined the organization of the Southern California Electric Company in Los Angeles.

G. R. Kenny, formerly rate research engineer with the San Joaquin Light & Power Corporation, Fresno, Cal., has resigned to accept a position with Stone and Webster in their Boston office.

C. A. Copeland, chairman of the Los Angeles chapter of the American Institute of Electrical Engineers, is making an extensive eastern trip which includes the national convention of the Institute.

A. S. Tyler, one of the pioneer contractors in Los Angeles, has opened a new store on Sixth Street near Western Avenue, where he will conduct a general contracting and merchandising business.

F. W. Smith, vice-president, United Electric Light and Power Company, New York, has just returned from Honolulu with Mrs. Smith. After a short visit in San Francisco they proceeded to New York.

M. J. Gavin, refinery engineer of the U. S. Bureau of Mines with headquarters at the Salt Lake station, visited the San Francisco office of the Bureau during June in connection with oil shale development.

A. H. Nicoll, telephone sales department, Western Electric Company, has returned to the San Francisco office of that company after an absence of seven years. During this time Mr. Nicoll was with the company in Salt Lake City in charge of the motor specialty sales and the power appliance department.

J. C. Marshall, assistant secretary of the California Association of Electrical Contractors and Dealers, has arrived in Los Angeles where he will be permanently located in the interests of the southern members of the association.

K. E. Van Kuran, John Jones and **Harry Fenton,** from the Los Angeles office of the Westinghouse Electric and Manufacturing Company, are making a trip through Arizona and New Mexico looking after Westinghouse interests.

G. A. Frogner, formerly with the Emergency Fleet Corporation, has accepted a position with the Crown Willamette Paper Company, to take charge of the installation of a new paper machine in the Oregon City mill of this company.

J. P. Jollyman, engineer of electrical construction of the Pacific Gas & Electric Company, San Francisco, left for the East July 8, where he will visit the factories of the principal manufacturers of electrical apparatus, returning within six weeks.

G. W. Bernhard has been appointed manager of the Northwestern Division of the Great Western Power Company of California, with headquarters at Napa. This division includes the towns of Santa Rosa, Petaluma and Napa and the surrounding country.

A. S. Moody, assistant manager of the Northwest District of the General Electric Company, has been visiting the various factories of his company in the East, having attended the various electrical conventions in California en route to his office in Portland.

C. H. Lee, president of the California State Water Commission, has commenced an investigation of the encroachment of salt water from the bay into the lower delta region, in cooperation with the State Engineering Department. This encroachment has had an effect not only upon agriculture but also in introducing the teredo, which is proving very destructive in piles, in some instances used for foundation work in power plants built along the Sacramento River.

Lloyd Henley, assistant electrical engineer, California Railroad Commission, has been appointed Valuation Engineer for the San Joaquin Light and Power Corporation as well as chairman of the committee on rules for overhead line construction in the state of California. This committee is to revise general order number 26 of the Railroad Commission and to incorporate in the revised order the requirements of chapter 499, statutes of 1911, as amended in chapter 600, statutes of 1915, thus placing all allied requirements under one cover. The committee is now working on the proposed order and will soon call a meeting of all interested parties to discuss the first draft of it. Mr. Henley graduated from Stanford University with the class of 1908 and entered the construction department of the Pacific Gas & Electric Company where he worked for two years, leaving the company to work for J. G. White and Company as electrical engineer in charge of the construction of the Bakersfield steam plant of the San Joaquin Light & Power Corporation. On the completion of this work Mr. Henley joined the Pacific Gas & Electric Company as engineer in charge of construction of Drum Power House and upon completion of the plant remained there as foreman until 1918, when he joined the Railroad Commission as assistant electrical engineer.

William M. Rosborough, until recently in the National Lamp Works at Nela Park, has been transferred to the Coast where he has assumed the duties of assistant to J. A. Vandegrift, Pacific Coast manager of the National Lamp Company. Mr. Rosborough has been with the company since 1910, first in the engineering department at Cleveland and then in Atlanta where he was the southern manager of the Selby lamp division. After that he served two years in the army as first lieutenant in the tank corps and upon his return was placed in charge of the manufacture and sale of foot-candle meters. He has been quite active in the work of the Illuminating Engineering Society.

M. O. Troy, manager of the transformer department of the General Electric Company's factory at Pittsburgh, recently spent a few days in Portland. Mr. Troy met some of the local engineers and discussed with them some of the new departures in transformer design.

S. J. Butts, president of the Los Angeles Association of Electrical Contractors and Dealers, is extremely proud of the high percentage of attendance from the South at the recent convention at San Jose. Fifty per cent of the membership from Los Angeles took the journey northward.

F. J. Airey, manager of the Los Angeles office of the Pacific States Electric Company, is making a six weeks trip in the East, visiting the various factories for which his company are distributors. He will also attend the General Electric Company's conference at Association Island.

D. H. Braymer, managing editor of Electrical World, who has been visiting on the Coast for some time, and **Robert Sibley,** editor of the Journal of Electricity, are taking a trip through the Northwest and Mountain states to observe the outlook for the expansion of the electrical industry.

E. W. Moreland, formerly with the Portland Railway, Light & Power Company, as efficiency engineer, has gone to Montreal to work with J. P. Newell on some appraisal work for the Canadian Government. Mr. Moreland will be engaged in these duties for some time, after which he will return to Portland.

S. J. Reno, sales manager for the Illinois Wire and Cable Company of Sycamore, Ill., was a recent visitor in Los Angeles on his return trip from Portland, where he attended the Shriners' convention. Mr. Reno states that his company is now doubling the capacity of its factory to care for increasing business.

R. E. Frickey, formerly electrical engineer for the Northern California Power Company, who, during the war period was engaged in electric welding at Hog Island, and later in electric welding at Philadelphia, is again located in San Francisco. Mr. Frickey expects to specialize in welding problems with headquarters in San Francisco.

C. E. Johnson, general manager of the U. S. Electrical Manufacturing Company of Los Angeles, has just returned from a tour through various eastern centers including Pittsburgh, New York, Boston, Schenectady, Detroit, Chicago and Milwaukee, where he has been studying the general business and financial conditions of these manufacturing centers.

P. B. McKee, vice-president and general manager of the California-Oregon Power Company, has become associated with Paul R. Parker and Donald McKee in the California Engineering Co. Mr. Paul McKee will still retain his position with the California-Oregon Power Company. Mr. Parker was manager of the ship yard at Benicia during the war and Mr. Donald McKee served in the Navy, receiving a commission as ensign. Mr. McKee is at present making a ten day trip over the California-Oregon Company's system.

F. O. Aspinwall, representing the Committee on Inflammable Liquids of the National Fire Protection Association, also connected with the Associated Factory Mutual Fire Insurance Company of Boston, Massachusetts, has been in California for several months making an exhaustive study of fire hazards in that state, also of the methods being used in California of extinguishing and preventing oil and gas fires.

Harris J. Ryan, of the electrical engineering department of Stanford University, has been elected to the National Academy of Sciences. This honor is accorded Professor Ryan in connection with his valuable work concerning high tension voltage. Two other Stanford professors have also been elected to the Academy: **Hans F. Blichfeldt,** professor of the mathematics department, for his contribution to the knowledge of pure mathematics, and **Bailey Willis,** professor of the department of geology, for distinguished work in the field of geology.

L. H. Newbert, president of the Pacific Coast Section of the National Electric Light Association, has appointed the following chairmen of the various committees for the coming year: **R. A. Balzari** of the Westinghouse Electric and Manufacturing Company, chairman of the Membership Committee; **J. A. Britton,** vice-president and general manager of the Pacific Gas & Electric Company, chairman of the Public Policy Committee; **P. R. Ferguson,** auditor, Southern Sierras Power Company, chairman Accounting Committee; **R. E. Fisher,** assistant manager commercial department, Pacific Gas & Electric Company, chairman of the Commercial Committee; **L. M. Klauber,** assistant general superintendent of the San Diego Consolidated Gas and Electric Company, chairman of the Engineering Committee, and **Robert Sibley,** editor of the Journal of Electricity, chairman of the Publicity Committee.

E. E. Stark, one of the pioneers of electrical develment on the Pacific Coast has just returned from New Zealand having been away from the United States for seventeen years. When in San Francisco prior to 1903 Mr. Stark was connected with the SKC system, while in New Zealand he had charge of a number of municipal plants.

Miles Steel, Pacific Coast representative of the Benjamin Electric Manufacturing Company, as announced in the Journal of Electricity April 15, 1920, has moved to new quarters. Mr. Steel has decided, however, to make the move complete and has lately taken unto himself a wife, formerly Miss Farrar Kennett of Butte, Montana. Mr. Steel has long since been given over as a hopeless bachelor, and now the news of his marriage comes as a very pleasing surprise to the members of the trade in the West. It looks as if this new start in the year 1920 augurs much for Mr. Steel, in happiness to himself personally and in helpfulness to the industry generally, which he has so faithfully served in past years.

OBITUARY

General William Crawford Gorgas, surgeon-general, U. S. A., died in London July 3 after a brief illness. General Gorgas will go down in history as the one man who did more for the advancement of the Central American States than any other, due to his work in sanitation in the Panama Canal district. Born in 1854 in the South, where he received his education, he early entered the army in the medical branch and continued to rise until he held the highest rank possible.

Meeting Notices for Electrical Men

(A presidential candidate spoke at one of the two meetings of the San Francisco Electrical Development League reported here, and a Ladies Day excursion to the Electrical Home was the special feature of the other. The annual dinner meeting of the Portland Sections of the N. E. L. A. and A. I. E. E. is reported along with the annual convention of the Telluride Association and the formation of a new chapter of the Society of Illuminating Engineers.—The Editor.)

The San Francisco Electrical Development League

Senator Owen of Oklahoma was the speaker of the day at a recent meeting of the San Francisco Electrical Development League. Previous to Senator Owen's speech, Mr. Henry Bostwick, district manager of the Pacific Gas & Electric Company, stated that the committee which had been appointed to investigate the feasibility of an electrical show for this year desired to report that it did not seem propitious at this time to hold a show. W. S. Berry asked that this report be held on the table until the jobbers had held a meeting and had taken some action. He stated that the majority of the jobbers believe that such a show should be held and the report of the committee was ordered held over.

Albert Elliot, "the electrical lawyer," was chairman of the day, and in introducing Senator Owen told of the active part the Senator had played in the passage of the Water Power Bill, and introduced him as the "father of the Federal Reserve Act."

In opening his speech, Senator Owen traced the history of the Republican party and stated that although he was a good Democrat he had always had a lot of respect for some of the Republican acts that had been started in the West. The Senator then stated that there is no apparent cause for a financial crisis at this time, that there are high wages, a shortage of labor, and that everybody is vigorously employed in productive processes and consequently the country should be in a prosperous condition. The criticisms of the Federal Reserve Board in raising the rate of interest so that there was no credit left for productive industries was denounced in no uncertain terms by Senator Owen, who proceeded to explain in detail the workings of the Federal Reserve banks throughout this country during the past year. The effect of this upon the electrical industry was shown by the Senator in that the raising of rates by the Federal Reserve Bank had made the savings banks charge ten per cent for money, which had made business men hesitate to go into productive business that involved a large expenditure of money. It was pointed out that there is the greatest need for United States products in Europe and need of United States food, raw material and machinery, to put Europe into a state of self-support. This condition will mean many years of big production for the United States, and the Senator urged in closing the development of water power of the West, as in this way the natural resources of the country will be made to serve the best interests of the people.

BUILDERS OF THE WEST — LXXXI

J. D. ROSS

In handling the municipal distribution of hydroelectric energy for illumination and industrial uses the West has unusual achievements to its credit along the lines of installation, operation and delivery. To J. D. Ross, Superintendent of Distribution for the City of Seattle, this issue of the Journal of Electricity is affectionately dedicated in appreciation of his contributions to the West in new ideals of management and in successful engineering installations for municipal distribution.

Portland Sections, A. I. E. E. and N. E. L. A.

The annual dinner meeting of the Portland Sections of the A. I. E. E. and N. E. L. A. was held at the University Club Tuesday evening, June eighth.

After the dinner acting chairman Heston announced the Pacific Coast Convention of the Institute to be held in Portland in July, discussing the program in detail. Brief verbal reports of the Pasadena convention were given by W. M. Hamilton and O. B. Coldwell.

The speaker of the evening was Mr. Edward L. Wells, meteorologist in charge of the Portland station. Mr. Wells went into the theory of meteorology and explained the formation of hail, sleet and snow, as well as the causes of storms of various kinds.

He spoke of some experimental work which he conducted while in charge of a station in Idaho, but which was never completed, and in which measurements of snow fall, moisture content and precipitation were made on watersheds and expressed it as his opinion that if comprehensive data of this kind were compiled over a period of years it would be of much value to utilities operating hydroelectric plants.

The results of the election of officers of the Portland sections of A. I. E. E. and N. E. L. A. for the ensuing year were announced, as follows:

A. I. E. E.

Chairman, W. D. Scott; secretary, W. C. Heston; executive committee, C. P. Osborne and O. L. LeFever.

N. E. L. A.

Chairman, A. D. Leach; vice-chairman, J. D. Scott; secretary, Geo. L. Meyers; treasurer, R. J. Davidson; executive committee, C. P. Osborne, A. S. Moody, C. L. Wernicke.

Synchronous Club Meeting

At the regular June meeting of the Synchronous Club of Los Angeles the subject of discussion was "Power Factor" and the principal address was given by W. L. Boxall, power contract agent of the Southern California Edison Company. Mr. Boxall urged cooperation between motor dealers and the central station in order that the best motor might be secured for the load. He went on to say that induction motors should be selected with the idea of being loaded close to their rating and that synchronous machines are recommended for many purposes, principally for motion picture production, so that the power factor may be improved and a greater amount of load carried by the existing generating and distributing equipment.

An enjoyable entertainment feature was the production of a one-act play, "Souvenir Spoons," which was presented by the Wallis Players Dramatic Club. An electrically cooked dinner preceded the meeting.

San Francisco A. I. E. E. Officers Elected

At the annual election of executive committee officers held by the San Francisco section of the American Institute of Electrical Engineers the following were elected: For two-year term, J. T. Ryan and J. P. Jollyman. For one-year term, A. J. Reed. The section chairman and other officers will be selected from among themselves by the executive committee.

Illuminating Engineering Society Chapter Formed

Following the action taken recently by a small group of members of the Illuminating Engineering Society who reside in the San Francisco Bay district, a petition was made to the Council of the Society to grant a Chapter charter for that section. This petition has been acted on by the Council and the charter granted, which makes the San Francisco chapter the first to be formed in the Society, all the other branch organizations being sections.

Upon receipt of the advice that the chapter had been granted a meeting was held in San Francisco on June 29, at which time the following officers were elected to hold office until the first of October, which is the beginning of the Society year: chairman, L. E. Voyer; treasurer, J. A. Vandergrift; secretary, H. H. Millar; board of managers, Miles Steel, W. Hanscombe, Romaine Myers, R. L. Prussia and W. P. Lowe.

To date, over 50 applications for membership in the Society have been received from engineers resident in the Bay district.

Ladies' Day, San Francisco Electrical Development League

The last meeting of the San Francisco Electrical Development League before the summer vacation was held on June 28th at the Palace Hotel in San Francisco. Following the usual custom, this was Ladies' Day, and the chairman of the day was Robert Sibley, editor of the Journal of Electricity and Pacific Coast Editor of the Electrical World and Electrical Merchandising.

During the course of the luncheon several songs were given by Lowell Redfield's quartet, and Albert Elliot presented a set of books to Arthur Halloran of the McGraw-Hill Book Company in recognition of the service he had rendered while secretary of the Pacific Coast Section of the N. E. L. A. Accepting this gift, Mr. Halloran stated that the set would be a memento of a pleasurable service and he expressed his heartfelt thanks to the individuals who had contributed toward it. Mr. Sibley then introduced Mr. D. H. Braymer, managing editor of the Electrical World, who stated that although this was his first visit to the West, yet he was not entirely a stranger to the wonders of the country west of the Rocky Mountains as he had been taking a correspondence course in this from Bob Sibley for the past six months. Mr. Sibley then introduced James H. McGraw, president of the McGraw-Hill Company, as the greatest publisher of engineering magazines in the world. Mr. McGraw spoke of the wonderful advance of the electrical industry on this coast, and the vast possibilities released through the passage of the Water Power Bill, and stated that the Electrical Trio, Electrical World, Electrical Merchandising and the Journal of Electricity, were there for the purpose of giving service to the men of the electrical industry, and that he felt great credit was due to Mr. Sibley for the manner in which he has upheld the West and brought it to the attention of the electrical engineers of the East. Mr. Sibley then introduced the speaker of the day, Judge William H. Waste of the Appellate Court, by stating that the spirit of the West had been exemplified in the Mission Play and that the Missions of California are the most picturesque traditions that have been handed down to us. Judge Waste traced the history of the west coast of America from the earliest discoveries, and cited those events which led up to the determination of the Spanish to conquer Alta California. He told of the expelling of the Jesuits and the subsequent appointment of Franciscan fathers who took charge of the Missions under Father Junipero Serra. Then followed a series of beautiful slides showing all of the existing Missions and sketches of those that have been destroyed.

Following the meeting, the ladies were taken out to the Electrical Home in St. Francis Wood where a special demonstration of the features of the home were given for their benefit.

Portland Contractor-Dealers

The regular meeting of the first district, Oregon Association of Electrical Contractors and Dealers, was held Monday, June 28, at the Chamber of Commerce.

The secretary read a report from G. R. Cooley, contractor-dealer of Seattle, on his trip to the N. E. L. A. convention at Pasadena, which was very interesting and caused considerable discussion.

Mr. Knight reported for the membership committee that, due to the demands made on his time on account of the Shriners' and other conventions, no progress had been made by his committee since last meeting. The secretary recommended that each member of the association constitute himself a member of the membership committee and assist Mr. Knight in his work.

The secretary recommended that the present system of trying to solve mutual problems of the contractor-dealer and jobber through the efforts of a large committee be discontinued, and that most apparent difficulties could be overcome by the contractor-dealer taking matters up individually with the respective jobbers, but that all matters of broad policy affecting the dealings between contractor-dealer and jobber be brought up and discussed at open meetings of the association. A motion to follow this plan was made and carried.

Acting chairman Sroufe, in discussing the relations between the jobber and members of the association, urged that the jobbers make it a point to have representatives at all meetings of the association in order that mutual problems may be fully and intelligently discussed.

The secretary reported that there was a movement on foot to start an electrical table for noon luncheons with the idea of bring all interested in the electrical industry in this district into closer touch with the purpose of getting better acquainted and thereby paving the way towards closer harmony in the industry.

The attendance was as follows:

Beaver Electric Co., Jaggar-Sroufe Co., E. L. Knight Co., R. N. Lewis, L. M. Olsiver, W. C. Heston, Fred Todd, Pierce-Tomlinson Co., R. R. Poppleton, Scott Electric Co., Vanderlip & Lord, Western Electric Works, C. M. Will.

Architects Enjoy Electrically Cooked Dinner

On the evening of June 24th, two hundred members of the Southern California Chapter of the American Institute of Architects attended a dinner given by the manufacturers who maintain exhibits in the Metropolitan Building in Los Angeles.

There were the customary papers and discussions, but the interest of the meeting centered in a turkey dinner prepared and served by E. C. Ebert, local Simplex representative.

After dinner the architects visited Mr. Ebert's display room where the dinner was prepared, and were very much surprised that so many could have been served with so little equipment. Everything except the string beans was cooked in the Simplex oven, the beans being prepared on the surface burner. The punch, salad, and ice cream were kept in an electrically operated refrigerator, and to make the job complete the dishes were washed in water from electric heaters.

Convention of Telluride Association

The annual convention of the Telluride Association, an organization which has for its purpose the education of young men along electrical lines, was recently held in Provo, Utah. A feature of the session was the presence of a large number

of the older members and alumnae, many of whom had served in the army and navy and were not discharged in time to attend the convention last year.

In addition to reviewing the work of the past year and making provision for the continuation of the various interests of the organization, the convention granted about twenty scholarships to Cornell University, where the association conducts its own house, and also granted a number of scholarships to other schools and universities. Provision was made for further development of Deep Springs ranch, California, where some of the applicants are trained for membership in the organization.

The officers elected for the ensuing year are:

William Dwight Whitney of New Haven, Conn., president; Earl C. Bonnett of Provo, Utah, vice-president; J. A. Boashard of Provo, secretary. The other officers are: F. C. Noon of Los Angeles, California, chancellor; E. A. Thornhill of Boise, Idaho, dean, and W. L. Biersach of Provo, manager and treasurer.

HAPPENINGS IN THE INDUSTRY

COMMENTS ON WATER POWER LEGISLATION

Now that President Wilson has signed the Water Power Bill, the comments on the situation by other technical journals are of interest. The following are extracts from editorials in Engineering News-Record, Electrical World, and Electric Railway Journal. The former notes that:

"In spite of the fact that Engineering News-Record is decidedly in favor of the bill, it has serious doubts of the validity of the signature which the President affixed to it some time before June 12, as announced at the White House on June 18. The whole issue hinges on an interpretation of the Constitution. The ten day limit on the Water Power Bill (as understood to be the meaning of Sec. 7, paragraph 2 of the Constitution) expired June 12. No notice of any action came from the White House until June 18 when it was announced that the President had signed the bill 'within the ten day period, of course.' Here is where the weakness of the Attorney-General's decision appears. If the President can wait one week before announcing the past signing of the bill, what is to prevent him waiting two months or two years?

"Engineering News-Record wants to see water-power development go forward. There never was a time when quick and decisive action was needed more imperatively. It therefore hopes that the constitutionality of the law's enactment will be decided at once so that all doubt of proceeding under it will be settled."

The Electrical World thinks that "the country is to be congratulated on the final enactment of the bill" which in its various forms has been before Congress for the last eight years, but expresses the opinion that the vicissitudes of the bill are a striking example of legislative inefficiency due to the shifting pressure of warring factions and clashing interests. The Electrical World notes that:

"Opposition was due to various forces, some of them raising debatable questions as to the rights of the states, others based on socialistic propaganda, and still others having their origin in the bogie of a water-power trust. As we have repeatedly pointed out, there is not, and never was, any such thing as a water-power trust, but only a growing recognition on the part of banking interests of the value of hydroelectric development as an investment looking to the future of American industries. Certainly the government will have it fully within its power through its commission to see to it that no menace to the public shall spring from this appreciation of values. In the actual working out of water-power development under this act the Federal Power Commission has almost plenary authority. It is composed of the Secretaries of War, of the Interior and of Agriculture, the three departments whose activities are most closely touched by the law. As a working body the efficiency of the commission will largely depend on the executive secretary and his staff, operating under the guidance of the Cabinet members named. It is just here that we hope the government will give the commission a very free hand to secure the best expert advice obtainable, for on this will hinge the ultimate success of the movement.

"At this time, when the fuel situation is monthly growing more acute, especially from difficulties of transportation, the help available from water powers is of vital importance, and the government cannot act too quickly in organizing the commission and laying the groundwork of something more than a local and limited system of distribution. The time has come for working on a large scale with a broad view of the industrial needs of the country. Our most earnest congratulations to the wise and far-sighted legislators who have seen the needs of the country and joined in putting through what promises to be one of the greatest constructive projects of the nation's history."

Electric Railway Journal also has some doubts as to the legality of the signature of the President but hopes that the bill is now a law in fact. They believe:

"The bill will provide a long-sought-for opportunity to develop economical power for our electric railways and industries. This legislation has had twelve years of rocky travel and there have been legitimate differences of opinion as to some provisions, but the result is that now the bill provides a basis upon which water power development may now begin.

"Most important, the bill gives recognition to the principle that the integrity of the legitimate investment in a utility of public service, such as water power development is, will not be impaired if the public decides to take over the business. At the same time, by the fifty year lease provision, the public is protected in case of future changed conditions.

"This legislation should encourage and invite capital which is seeking an investment field rather than a speculation. The result will be a hydroelectric power business, on a sound basis, which will be a factor in the electrification of trunk lines, in economical power production for existing railways and industries and in coal (and oil) conservation."

P. G. AND E. CO. AND GREAT WESTERN POWER CO. GRANTED RATE INCREASES

The Pacific Gas and Electric Company and the Great Western Power Company have been authorized by the Railroad Commission to increase their rates for electricity by the addition of a 10% emergency surcharge to apply on all bills rendered beginning with July 10, 1920, and ending with April 10, 1921, a period of nine months. The Commission's decision adds to the standard rate schedules of both companies the surcharges that have been allowed on previous applications, the emergency percentage increase granted being imposed on the combined rates. The effect will be a fifteen per cent increase over the amounts that have been collected in recent months. In the case of the Pacific Gas and Electric Company it is estimated that the new emergency rate will produce additional revenue of $2,200,000 for the year ending July 1, 1921.

Shortage of water power and the consequent necessity for the production of a large quantity of electricity by steam (using fuel oil costing $1.81 a barrel) and increases in wages are responsible for the surcharge. The period of nine months for the collection of the surcharge is fixed by the Commission in the belief that by next April sufficient new hydroelectric power will have been installed to considerably reduce the production of expensive steam power.

The increase in rates applies to all territory served by the Pacific Gas and Electric Company, including that operated under lease from the Sierra and San Francisco Power Company, and the territory recently acquired through the purchase of the properties of the Northern California Power Company. In the case of the Great Western Power Company the Commission directs that company to bring to the level of

its other rates its charges for municipal street lighting, street railway power and power sold to other public utilities, which three classes of service were exempted when surcharges were originally fixed in July, 1918.

The following, from the opinion in the Pacific Gas and Electric Company's case, is a summary of the Commission's estimates of the company's revenue and expense for the twelve months commencing April 1, 1920:

Gross revenue	$19,320,300
Inter-department revenue	322,200
Total revenue	$19,642,500
Maintenance and expenses	2,040,000
Operating expense	3,150,000
Fuel oil	4,866,000
Purchased power	580,000
General expense	598,000
Uncollectible bills	55,000
Insurance reserve	80,000
Taxes	1,200,000
Depreciation	1,450,000
Total expense	$14,019,000

The Commission's engineers estimated that the Pacific Gas and Electric Company's output for the year 1920 would total 1,430,000,000 kw-hr. as against the company's estimate of 1,411,514,990. The Commission's estimate on purchased power is 110,000,000 kw-hr.; the company's, 104,700,000. In its estimate of power to be produced by steam the company claimed 610,900,000 kw-hr. The evidence showed a production of 570,000,000. Hydroelectric power aggregating 750,000,000 kw-hr. will be produced, according to the Commission's estimate. The company figured on 695,911,664.

The company's claim for maintenance totaled, including wage increase of April 1, 1920, $2,052,908. The Commission's allowance is $2,040,000. The company's oil estimate of $5,127,050 is reduced to $4,866,000 by the Commission. The allowance of $3,150,000 for operating expense for 12 months includes $275,000 for salaries and wages, an increase effective April 1st. The company estimated $3,174,627.

In a further discussion of the Pacific Gas and Electric Company's case Commissioner Devlin made following remark:

> The nature of the proceeding upon which the present order is based is such that detailed analysis * * * cannot, by reason of the emergency character of this part of the proceeding, be made. Such analysis will be postponed for further hearing.
>
> No prejudice will be suffered if increases do not result in an unreasonable return. Sufficient analysis has been made to determine that no injustice is done the consumers. The company's property should be maintained in first-class condition. It would be false economy to reduce maintenance at this time. It would result only in decreasing the quality of service in the future.

The following is from the decision in the case:

> Money invested during the last two years has cost considerably more than previously. Certain securities cost approximately 6 to 6½ per cent prior to the war. The financing during the past year and a half has been at a rate of between 7 and 9 per cent and the money which has been borrowed to carry on the developments the company is now commencing is costing 8.88 per cent.

On July third the following editorial on this rate increase appeared in the San Francisco Chronicle:

> **RATES FOR UTILITY SERVICE**
>
> The Railroad Commission has authorized an increase of 15 per cent on the rates for electric current to be charged by the Pacific Gas and Electric Company and Great Western Power Company, the surcharge to continue until April 10, 1921. That is in accordance with the policy of the Commission not at this time to authorize permanent increases in rates charged by public utilities, but to grant aid in the form of surcharges to continue for a limited period "until the clouds roll by."
>
> They are necessary. We need the development of water for the creation of power, the irrigation of land and for industry and domestic use. We need from the public utilities the best service which can be given and, within reason, the reliability and quality of service is paramount to the question of cost.
>
> We shall not get any of these things except by the very large and for many years the constant increase of capital investment. We shall not get this investment except by reasonable assurance to capital of reasonable return on that investment or by extorting it from the taxpayers, with the reasonable assurance that there will be no return.
>
> The people of the country prefer to attract private capital to these services by the reasonable assurance of reasonable return. Those who imagine that they do not pay any taxes might not be concerned as to where the money comes from except that they are the most insistent of all for a high quality of service, which they will not get from any government.
>
> So long as rates for public service are fixed by representatives of customers the public is certainly in no danger of extortionate rates. All but the reds are willing to pay fair rates.
>
> Consequently enlightened public sentiment will favor the granting by rate fixing bodies of whatever rates are necessary to pay for the service demanded.

ELECTRICAL DEVELOPMENT LEAGUE'S HETCH-HETCHY TRIP

The itinerary for the excursion of the Electric Development League to Hetch-Hetchy is as follows:

Friday, July 16th—
8:00 p.m. Leave San Francisco—Santa Fe Train No. 2—in special Pullman cars.

Saturday, July 17th—
12:18 a.m. Arrive Riverbank.—Thence to Hetch-Hetchy Junction via Sierra Railway as a special train.
8:06 a.m.—Arrive Rattlesnake Creek and Priest Portal.—Inspect Aqueduct Tunnel construction and Priest regulating reservoir site.
10:15 a.m. Arrive Big Creek Camp.—Shaft to Aqueduct Tunnel, 566 ft. below surface, two tunnel headings.
4:15 p.m. Arrive Hetch-Hetchy Valley, Damsite Camp.—Inspect main storage dam construction (Utah Construction Company).

Sunday, July 18th—
8:00 a.m. Leave Damsite.—To Early Intake Camp via tramway.—Inspect Early Intake Power House.—Power House Aqueduct and forebay flume.—Inspect tunnel.—To Intake Siding via tramway.—Visit South Fork Portal of Aqueduct tunnel.
4:45 p.m. Arrive Groveland.—Headquarters Building, Railroad Shops, Warehouse, Hospital, Employes' Club House.
7:00 p.m. Leave Groveland.

Monday, July 19th—
7:30 a.m. Arrive Ferry Building, San Francisco, via Santa Fe Train No. 11.

INDUSTRIAL CONSTRUCTION IN THE NORTHWEST

The Crystal Ice & Cold Storage Company is erecting a new 5-story concrete building on the quarter block adjoining their present plant in Portland, Oregon. This will be the most modern ice cream factory on the Pacific Coast. The plant will be electrically operated throughout—special lighting arrangements and ice cream hardening rooms with a capacity of 40,000 gal. per 24 hours are some of the features of the plant. These hardening rooms will be lined on all sides with pure cork 8 inches in thickness. The total installed motor capacity will be 230 hp., individual drive being used almost exclusively.

The Oregon Pulp & Paper Company are constructing a paper mill at Salem, Oregon, for the manufacture of tissue and high quality glazed book paper out of wood pulp. The Portland Railway, Light & Power Company have entered into a contract with the paper company to supply them with 1500 kw. of electric power at a potential of 60,000 volts. The daily output of the mill will have a value of $5,000.

CALIFORNIA-OREGON POWER COMPANY APPLIES FOR RATE READJUSTMENT

The California-Oregon Power Company has applied to the Railroad Commission for an order readjusting its rates and charges for electric energy and for a modification of certain contracts under which it has been delivering electric electric power to three irrigation projects in Siskiyou county. The holders of the contracts are the Shasta River Water Association, the Big Springs Water Company and the Lucerne Water Company. The last named company is paying three-fourths of a cent per kw-hr. for its energy. The other companies are getting power upon a flat rate basis of $2.50 per acre per year. The flat rate contracts have been in existence since 1913 and the Lucerne contract since 1916.

The power company asks that the contracts be modified or canceled, charging that the water companies have indulged in practices conducive to an uneconomical use of both electric energy and water. It is claimed that there has been, on the part of the water companies, a violation of the terms of the contracts governing the use of electric energy.

The company asks for a final readjustment of its rates on the ground that it is now in a position to determine the effect upon its revenue of the rates fixed by the Commission on a previous application. In its former decision the Commission ordered the company to install meters with the result that today more than ninety per cent of its consumers are being served on a meter basis, a fact set up by the company in its request for a final readjustment of rates. It is further claimed by the company that it has in prospect "the reorganization of its financial structure with the view to enabling it more readily to obtain the necessary funds for the construc-

tion of new power plants or increasing the capacity of existing plants, and making extensions and enlargements of its system for the logical and proper development of its territory." Continuing the company says:

"The applicant believes that with the readjustment of its rates and charges so as to enable it to earn an adequate return for the services now being rendered and the consummation of the reorganization plan, it will be able to provide securities that will permit it to obtain the necessary funds for attaining the larger ends."

It is claimed that the value of its California holdings, for rate making purposes, is $4,377,079. The value of the Oregon properties is given as $2,814,744.26.

POWER RATES CUT BY STATE BOARD

Two rulings of unusual importance have been filed by the Public Service Commission of Washington. In one of these the commission reduces the earnings of the Puget Sound International Railway & Power Company on its Everett business from 43.60 per cent upon electric power current, and from 11.61 per cent upon light current to 8 per cent upon the valuation of each.

In its second order the commission directs the North Coast Fower Company to repay the city of Centralia the full amount of rate increase collected by the company from the city prior to July 1, 1920, collection of which increase was commenced by the company on December 20, 1919, on wholesale rates for current supplied the city lighting plant. The increase ordered repaid amounts to about $800 for each of the seven months covered by the order of the commission. The increased rate, however, becomes effective July 1, as previously allowed.

In the Puget Sound International Railway & Power Company order, affecting Everett rates, the commission accepts the company's challenge of state jurisdiction for regulatory purposes over electric energy sold for power. In doing this the commission undertakes to separate and value for rate making purposes, current sold for lighting and that for power. It is considered certain that this ruling will be contested in the Supreme Court on a former Supreme Court decision in what is known as the Inland case from Spokane, wherein the court held in effect that sale of surplus or "dump" power should not be considered a public use, subject to commission regulation, but a use subject to any disposition the company might be able to make of it.

In the Everett ruling the commission concludes that the Supreme Court in the Inland case did not intend to exclude from commission regulation different conditions such as it finds exist at Everett in the sale of power current as an established business.

In finding the Everett rates unreasonable and more than sufficient the commission directs the company to file within ten days a reduced schedule of rates applying to all light and power service which will yield the company an annual net return of 8 per cent upon the valuation fixed by the commission for the light and power systems singly and combined as of December 31, 1918, with net additions and betterments to June 1, 1920.

The company is also directed to file with the commission copies of all contracts with light and power users that are in conflict with the new schedule of rates, and the city of Everett is similarly directed to file certified copies of its franchises and contracts with the company.

The North Coast Power Company sells light current to the system owned by the city of Centralia. On the company's complaint in 1919 the commission made a valuation of the Centralia business of the company, found that the company had been losing 3.40 per cent annually under the old contract rates and allowed as a fair and reasonable return increased rates bringing the annual earnings up to 1.97 per cent on the investment.

In reopening the rate upon application of the city of Centralia and finding the company to have exceeded its authority in collecting the new rate without formal cancellation of the previous contract by regular order, the commission lays down the rule that affirmative action by the commission must be taken before such contracts can be legally voided.

MECHANICAL ENGINEERS DISCUSS CODE OF ETHICS

A proposed new Code of Ethics, prepared by a committee of Mechanical Engineers, but intended to serve as a basis for a code of principles for all engineers, was discussed at the semi-annual meeting of the American Society of Mechanical Engineers, held in St. Louis recently.

The essential feature of the Code is its brevity—it contains but fourteen short paragraphs. The Code is intended to be a brief, positive statement of the professional relations of engineers to the public, to their clients or employers, and to one another.

The committee formulating the Code recommended the establishment of a Standing Committee on Professional Conduct to interpret it, and also to judge cases of questionable ethical conduct on the part of engineers. The personnel of the committee was as follows: A. G. Christie, chairman, Robert Sibley, John V. Martenis, H. J. Hinchey, Charles T. Main.

NEW ZEALAND HAS LARGE HYDROELECTRIC PROGRAM

Over thirty million dollars is to be expended by New Zealand for the development of hydroelectric power, the largest project being located at Arapuni, about 126 miles south of Auckland. Besides this project for which the government has appropriated $21,899,250, there are a number of municipal and private hydroelectric projects in various stages of development throughout the dominion. A loan of $7,300,000 has been authorized for the construction of a hydroelectric plant at the outlet of Lake Monowai and will supply current to Invercargill and the surrounding country.

The city council of Wanganui purposes to develop a hydroelectric power plant at the source of the Wangaehu River, about thirty miles from the town, and it is estimated that the cost will be $1,216,625. The plant will develop 6,000 horsepower and will be submerged in the dam. This is the first plant of this kind to be installed in the British Empire.

VANCOUVER TO INSTALL STREET LIGHTING SYSTEM

A report on the cost of installing a permanent lighting system in Vancouver will be presented to the city council at its next regular meeting, at which time it is hoped to have enough property owners' signatures to a petition to insure the new system.

The lights are to be installed on an 8800-foot front in the business district, six to the block, with three to each side of the street. The estimated cost of the installation is $26,400, including interest on bonds, or an annual cost of 30 cents per front foot. Costs are being compiled on cluster lights and a single light to each post.

PACIFIC GAS AND ELECTRIC COMPANY'S PETITION DENIED

The Pacific Gas and Electric Company will not be allowed to discontinue supplying water for power purposes to mines in Nevada county, the Railroad Commission having ordered a dismissal of the application. The application was opposed by Nevada City and Grass Valley, the Indian Springs and Wolf Creek Water Users' Association, New Blue Point Mining Company, Empire Mines and Investment Company and North Star Mines Company. In the opinion accompanying the order in the case the Commission says:

Deprivation of the water now supplied by the company to the mines and irrigators in Nevada county would be unwarranted and would result in very substantial and unjust prejudice to those water consumers, and there would be no sufficient corresponding or compensating benefit to the public in the increased production of electric energy.

AMERICAN DELEGATES ATTEND MEETING OF ADVISORY COMMITTEES IN BRUSSELS

Meetings of the Advisory Technical Committees of the International Electrotechnical Commission were held in Brussels during the past Spring months. The meetings were attended by delegates from eight national committees—Belgium, France, Great Britain, Holland, Italy, Spain, Switzerland, and the United States. There were about 40 delegates in all.

Although official decisions of the Commission are made only in plenary meetings, much of the work of the Commission is accomplished in the meetings of the Advisory Committees. Four of the Committees met at Brussels, namely: Rating, Definitions, Graphical Symbols, and Standard Voltages.

The meetings were attended by six American delegates: Messrs. C. O. Mailloux, C. E. Skinner, H. M. Hobart, A. H. Moore, L. W. Chubb, and P. G. Agnew. Dr Mailloux is president both of the International Electrotechnical Commission and of the United States National Committee.

Rating —

The Advisory Committee on Rating was presided over by Mr. Guido Semenza of Italy. The principal results of the meeting of this committee were the acceptance of:

1. The hot-spot principle as a basis of standardization.
2. The classification of insulating materials.
3. The classification of methods of measurement.

At the request of the American delegates the question of the terminal marking for transformers was deferred with the understanding that the American committee would submit a scheme sufficiently comprehensive to include all classes of apparatus and machinery.

Definitions —

This committee held joint sessions with the committee on Symbols, under the presidency of Professor Janet of France. Definitions of about 60 terms were approved. There was considerable discussion as to the advisability of attempting the preparation of a fairly complete International Electrotechnical vocabulary. Such vocabularies have been prepared by the national committees of France, Holland, and Italy. It was decided that these might serve as a basis of an international vocabulary, and a special committee was authorized for actively undertaking the work of its preparation.

Symbols —

The Italian graphical symbols which had been formally submitted by the Italian National Committee at a previous meeting, were taken as a basis for discussion. The comprehensive list prepared by the British Engineering Standards Association, and Mr. Cheney's paper in the Journal of the A. I. E. E. for February, 1920, which embodied the work of an A. I. E. E. sub-committee, were used as supplementary documents. Agreement was reached upon a list of about 100 symbols.

Standard Voltages —

Owing to variety of circumstances, a great many voltages are now used in Europe, and in the absence of standardization work, other voltages are being added. The European delegates felt strongly that immediate work should be done on two subjects—the standardization of voltages up to about 50,000, and the standardization of specifications for pin insulators. Some tentative proposals were formulated for the consideration of the various national committees. In informal conversations it was urged upon the American delegates that it would be very desirable for a comprehensive statement of American practice, accompanied by proposals, to be prepared and forwarded for the consideration of the other national committees.

MERGER OF COLORADO POWER COMPANIES

The Home Gas and Electric Company of Greeley, Colorado, is to purchase the Farmers Electric and Power Company of Eaton, exercising an option which it has held for the past six months. The Farmers Electric and Power Company serves all the territory from the north limit of Greeley to the town of Pierce, together with the territory surrounding Lucerne, Ault, Eaton and Pierce. The pumping plants of the Great Western Sugar Company which irrigate about 17,000 acres of land will be included in the purchase, as will the contracts now pending to supply the towns of Nunn and Pierce with electric current.

LOS ANGELES GAS & ELECTRIC CORPORATION

The Los Angeles Gas & Electric Corporation is to issue $1,500,000 of bonds which are to be deposited as security for $1,000,000 of four-year notes. The money is to be used to pay in part for permanent extensions, additions and betterments to the company's plant. The company estimates that its expenditures for construction work in 1920 will aggregate $1,541,260.

NATIONAL COPPER PRODUCTION

The production, export and domestic consumption of copper is a matter of prime importance to public utility companies, as they are great users of copper and the cost of copper is of interest to them at all times.

Statistics recently compiled show that the copper mines in the United States produced about 5% less in November than in October. The lowered price of copper and the strikes were the chief causes of this decrease in output. Fifteen companies, which produced about 75% of the country's output, produced in October 85,263,370 lb., and in November 81,198,170 lb.

The reasons for the decreased production are clear to anyone who has followed the situation in the industry and

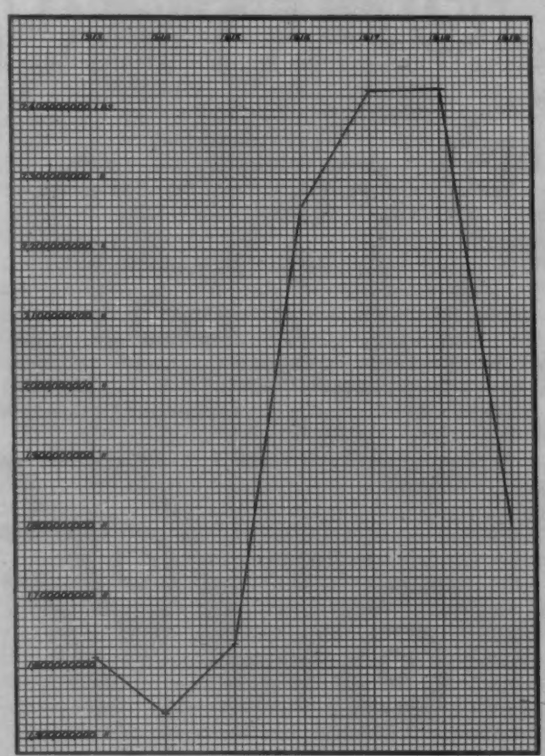


Chart illustrating the copper production of the United States during the past six years

the turn of events during the past year. Immediately after the Armistice was signed there was an evident anticipation of a sustained and pronounced demand for copper to meet the great need of that metal for reconstructive purposes. When it became apparent that this demand would not materialize due to political, financial, and labor troubles, the industry was faced with the problem of disposing of an enormous copper surplus which at the beginning of 1919 was estimated at 1,500,000,000 lb. Today, while there is still a large surplus of copper in the United States awaiting market, foreign orders are in sight which make the situation appear more optimistic. In some quarters it is estimated that manufacturers are consuming about 75% of normal refinery production. In former years the domestic demand consumed about one-half the production. The curtailed output of the copper mines will insure keeping the surplus reasonably low.

The figures below will give some idea of the enormous and sudden curtailment in production that has taken place during the last year:

COPPER PRODUCTION IN U. S.

1913		1,615,000,000 lb.
1914		1,533,781,000 "
1915		1,634,000,000 "
1916		2,259,000,000 "
1917		2,428,000,000 "
1918		2,432,000,000 "
1919	(estimated)	1,800,000,000 "

Exports of copper for November show a marked decrease from October and were only about half the amount exported in September, while imports increased, totaling 52,800,383 lb. for November as against 28,043,510 lb. in October. Thus it appears that more copper is coming into the United States at the present time than is leaving it. While figures over one month are not very significant, should this ratio continue it would be a disturbing and unhealthy factor in the copper situation.

TRADE NOTES

In Charge of Industrial Furnaces —

George P. Mills, formerly electrical sales engineer of the General Electric Company, Philadelphia, has joined the staff of the Electric Furnace Construction Company, Philadelphia, to take charge of and specially develop electrical industrial heating furnaces.

Warehouse to be Moved —

The National India Rubber Company of Seattle will move its warehouse and office from 524 First Avenue South to 570 First Avenue South on or about the first of July.

Change of Position —

J. C. Manchester, district manager of the Economy Fuse and Manufacturing Company, has resigned his position with that company to become distributor of the Disteel Wheel in southern California and Arizona. George C. Bryant will become the manager of the Economy Fuse and Manufacturing Company, succeeding Mr. Manchester. George W. Davis, Los Angeles representative for the Economy Fuse, will assist Mr. Manchester in the distribution of the Disteel wheel.

Extension of Branch Offices —

The Milliken Brothers Mfg. Co., Inc., Woolworth Building, New York, manufacturer of steel transmission towers, radio towers, steel poles, and all-steel industrial buildings, known as Milliken Buildings, is now devoting a large part of operations to the last noted specialty. These buildings are used by electric companies for substations, storage buildings, warehouses, and other utility structures. To give customers best attention and service, the company has arranged for branch offices in the following cities, with representatives as noted: Chicago, Majestic Building, the Gagen Sales Corporation; Cleveland, Builders' Exchange, the Clymonts-Mohrman Company; Raleigh, N. C., Structural Supply Company; Atlanta, Ga., 1317 Third National Bank Building, Beaullieu & Applewhite; Chattanooga, Tenn., Volunteer Life Building, O. B. Stauffer; New Orleans, La., Ole K. Olsen, 822 Perdido Street; Tulsa, Okla, Industrial Construction Company; Dallas, Tex., 1504 Commerce Street, Moore, Shotts & Wilson Company; Houston, Tex., David M. Duller, Houston Land & Trust Company. M. T. Walsh, Havana, Cuba, will act as sales representative for the company in that territory. The Milliken Manufacturing Syndicate, Ltd., London, will handle business in various European countries, while Australian territory will be covered by Gordon & Gotch, Ltd., Melbourne, Australia, with branch offices in other cities. Headquarters, heretofore located on the eighteenth floor of the Woolworth Building, New York, have been removed to larger offices on the twentieth floor of the same building, effective May 15.

New Building —

The Chicago offices of The Cutler-Hammer Manufacturing Company of Milwaukee and New York have been removed from the Peoples' Gas Building, where they have been located for the last eight years, to the company's own building on the new Michigan Boulevard link. Because of the rapidly growing business in the Chicago territory the fifteen offices comprising the C-H quarters in the Peoples' Gas Building were no longer large enough, so that the new building was necessary.

Paul Howse, president of the Electrical Products Corporation of Los Angeles has, with his associates, developed what many term the best equipped sign factory in the United States. The story of the development and present success of this company is told in an article which appears on other pages of this issue of the Journal of Electricity. Mr. Howse deserves credit for what he has done in opening up a market for electric signs in the Orient and in developing the idea of interchangeable signs for theatre fronts.

Heckert L. Parker, who has recently resigned as vice-president and secretary of the Conneaut Metal Works of Conneaut, Ohio, has opened a manufacturers' agency at 111 New Montgomery Street, San Francisco, and will represent the Seidler-Miner marine electrical signalling apparatus consisting of signal and fire alarm equipment and inter-communicating telephones and will also represent the Globe Machine and Stamping Company of Cleveland, Ohio, who manufacture the Sepco line of electric heating devices. In addition to this Mr. Parker will act as agent for the Conneaut plastic metallic packing lines. Mr. Parker, who is an associate member of the A. I. E. E. and a member of the I. E. S., has had wide experience in marine electrical work, having served as a member of the committee on electrical specifications in charge of the electrical work on the Leviathan, which is now being reconditioned, and was the manufacturers' representative appointed to work out the ornamental electrical fixtures and illumination features with the naval architects and electrical engineers of the private yards who are now building passenger vessels for the U. S. Shipping Board.

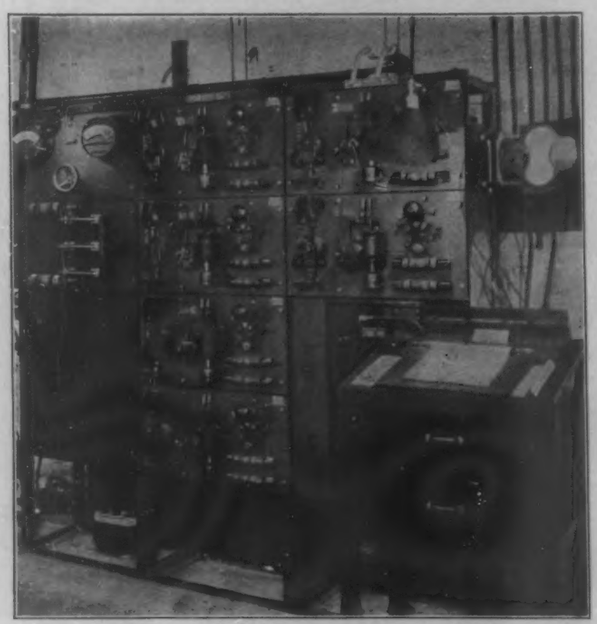
LATEST IN EVERYTHING ELECTRICAL

(The electric truck is daily being more widely used in every type of industry and for this reason considerable interest is centered around the automatic charging equipment described on this page. Those concerned with interior illumination will be interested in the bracket and cluster which are described and illustrated here. Electricians and mechanics will find that the tool chest presented on this page possesses several unusually convenient features.—The Editor.)

AUTOMATIC CONSTANT POTENTIAL CHARGING EQUIPMENTS FOR TRUCKS

The new automatic type of constant potential charging equipment shown in the accompanying illustration is manufactured by the Cutler Hammer Manufacturing Company, of Milwaukee and New York. This is a unit section to be mounted on the standard floor-type frame for charging electric trucks.

It consists of a slate panel carrying a single pole magnet switch, a solenoid relay, a manually operated main line switch and two enclosed fuses. The panel is 15 inches high and 24



The constant potential charging equipment shown above is for charging the electric truck which is becoming so popular in every type of industry.

inches wide, and is drilled for mounting on the standard floor-type frame, which is capable of assembling from one to four sections. Each section is a complete charging unit in itself, and they may be assembled as needed, like the sections of a bookcase. The charge is started by moving the main line switch, which is mounted on the right of the panel, to the "on" position and inserting the charging plug in the battery receptacle.

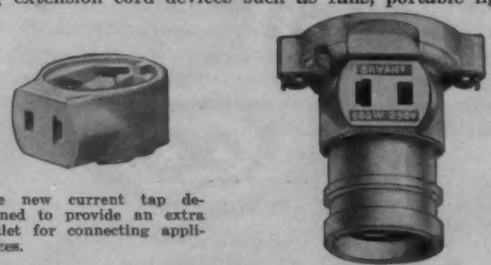
The main switch may be left in the "on" position and the charge started by simply plugging into the battery. The panel automatically takes care of the charging rate so it is properly tapered, and an attendant's presence is not necessary until the charge is completde, when he terminates it by moving the main switch to the "off" position or by pulling out the charging plug. The charge can also be discontinued by the opening of a shunt trip circuit breaker controlled by an ampere-hour meter on the vehicle.

The solenoid relay, which is set in motion by inserting the charging plug in the battery receptacle, is sufficiently retarded by a dash-pot to insure being seated before the magnet switch closes to complete the circuit. A duplex meter mounted on a swinging bracket to the right of the frame gives simultaneous readings of the charging current and battery voltage when the main switch is moved to the third, or "meter reading" position. A spring automatically returns the switch from the "meter reading" to the "on" position. The charge is automatically given a tapering rate by means of a fixed resistance, which is designed with a proper capacity for the battery to be charged.

SPARTAN CURRENT TAP

For use in connection with the sockets and bases of the interchangeable porcelain line, the Bryant Electric Company, of Bridgeport, Connecticut, have recently produced the current tap shown in the illustration below.

This device is made of porcelain with a glazed finish. It is designed for convenient insertion between the porcelain base or cap and the socket to provide an extra outlet for connecting extension cord devices such as fans, portable lights



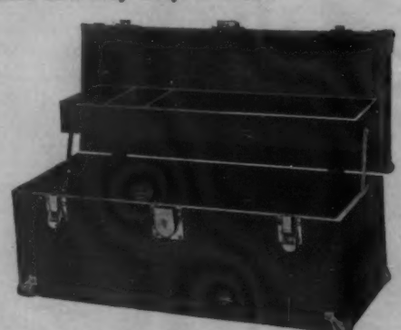
The new current tap designed to provide an extra outlet for connecting appliances.

and water heaters. The tap part is of the standard Spartan Type which will take any of the standard parallel blade plugs.

The arrangement of terminals is such that current can be used off the tap without interfering with the use of a lamp in the socket.

TOOL CHEST FOR ELECTRICIANS

A new tool chest for electricians, mechanics, etc., is the "Utility" type manufactured by the Union Tool Chest Co., Inc., of Rochester, N. Y. It is made in two sizes, 16 inches and 19 inches, and has a tray fitted with movable partitions. The tray is fixed to the cover and is automatically raised out of the way when the chest is opened, leaving the contents of both chest and tray easy to reach.



The Utility type tool chest for electricians and mechanics. This view shows how the tray is conveniently out of the way when the chest is opened.

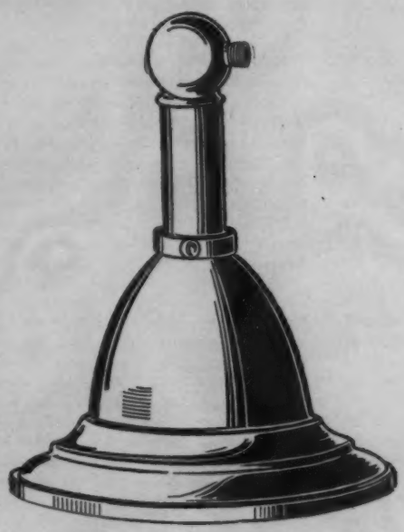
The handle is genuine leather, steel-cored, and is attached with heavy cotters which prevent its being pulled out of the heavy nickeled steel loops. It will carry any weight.

FIXTURES FOR THE HOME

Three-Piece Bracket

This new E-Z wire three-piece bracket put on the market by the Peerless Light Company is a combination of three distinct attachments.

The arm, No. 1891, is the regular single piece, made of solid brass and similar to the No. 1978 cast arm but made of high-grade drawn brass tube throughout. This single piece



The new E-Z, Three Piece Bracket

arm gives its service, formerly secured by assembling a number of individual attachments.

The slip canopy is the standard No. 1120 and the ⅜-in. crowfoot is No. 617. All the surface parts are of the B-B. finish.

Double-Duty..Cluster

The double-duty cluster is so named because it combines simplicity of construction,artistic appearance, and service. The cluster is a one-piece casting of high grade brass. Its sturdy construction enables it better to withstand the jar-

This cluster is an example of the type of fixture which adds to the beauty and convenience of any room. Sturdy structure does not detract from the appearance yet adds to its durability.

ring effects of switching on or off the lights. It is equipped with two pull chain sockets giving individual control of the lamps. In another form is is completed with one keyless socket and one pull chain socket, so wired that both lights are controlled by one motion.

Book and Bulletins

Drainage Engineering

By D. M. Murphy. 178 pages, 6 x 9; well illustrated. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco.

Drainage is so inseparably associated with land reclamation and food production in the West that irrigation and agricultural engineers and students should welcome this new volume as a help in their work. The author was for many years associated with the U. S. Reclamation Service as drainage engineer and during that time, as well as during his subsequent consulting practice, has had an unusual opportunity to observe and interpret drainage problems. This text gives to the engineer the results of the author's observation and experience in a form that can be applied to the solution of his own problems, whether they concern the draining of natural swamps or water-logged lands. The first three chapters are devoted to a discussion of soils, growth of plants and water supply. Then follow three chapters on drainage, including fundamental factors, benefits and methods of investigation. The next three chapters have to do with construction, location and capacity of drains. The final chapter discusses economic considerations.

Direct Current Motor and Generator Troubles

By T. S. Gandy and E. C. Schacht. 274 pages, 5½ x 8; 109 illustrations. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco.

It is most refreshing in these days of multifarious book production to find one written by men who know what they are writing about and know how to impart this knowledge. Such is the case with this new book. Furthermore, it goes at once to the heart of its subject, telling why a d.c. motor or generator does not run and how to make it run. From observed symptoms the operator is taught the cause of any given trouble and told how to remedy it. It is essentially a book for the operating man, not the designer. He is told how to select a motor or generator to meet given requirements, how to erect the machine, how to start it, keep it running, test it and repair it. It is a concise, practical and usable text that should be in the hands of every man who handles d.c. equipment.

Elements of the Precision of Measurements and Graphical Methods

By H. M. Goodwin. 116 pages, 6 x 9. Published by McGraw-Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco.

This text shows how to apply the mathematical laws of error to experimental observations. The author is professor of physics at the Massachusetts Institute of Technology. While it is written primarily for the use of students in the physical laboratory it should prove of value to engineers engaged in experimental testing. The purpose is to illustrate the practical use of the theory of probability and the method of least squares. The first part of the book discusses principles and computations, the second part is devoted to graphical methods and the third part to problems and the solution thereof. This is a second edition of a work well adapted to the use of those who wish to work up the subjects without additional instruction.

Trade Bulletins

The Delta-Star Electric Company, Chicago, Illinois, are distributing bulletin number 303, describing their 100-amp., 600-volt, three-phase plugs and receptacles, for extra heavy duty. These equipments are included in the list of electrical appliances issued by the Underwriters laboratories. Copies are sent upon request.

NEW ELECTRICAL DEVELOPMENT

(The Northwest reports plans for the construction of several hydroelectric plants. Arrangements for the power supply of East Bay cities and a report of threatened power shortage appear among Pacific Central items. The proposition of a municipally owned electric power plant appears in the Pacific Southwest section while the Intermountain district reports increases in rates as well as plans for the enlargement of power plants and the development of additional hydroelectric power.—The Editor.)

THE PACIFIC NORTHWEST

BEND, ORE.—Larger power developments are to be made by Bend Water, Light & Power Company calling for 4233 horsepower on Tumalo Creek.

SCIO, ORE.—State Engineer, Percy A. Cupper, grants this place a right to appropriate water from Thomas Creek for the development of 362 horsepower for municipal purposes.

CENTRALIA, WASH.—The Kane Pneumatic Shock Absorber Company of this city is to build a 1500-kw. power plant at Ford's Prairie, according to President P. W. Kane of the company.

SPOKANE, WASH.—The International Portland Cement Company will construct a quarry at Portrock, Idaho, on the Pend Oreille lake, according to G. A. Irvin, treasurer and general manager of the company. The sum of $50,000 is being spent on a power plant and crusher alone.

SHELTON, WASH.—County commissioners have granted to Olympic Electric Reduction Co. a franchise to transmit electric current over the roads of Mason county. This company holds power site and rights of Frank McKean in the Skokomish river and already has a tunnel driven to conduct water for turbine purposes.

SEATTLE, WASH.—Condemnation proceedings started by the city of Seattle in its plan to build a power plant on the upper Skagit river will be opposed by Whatcom county. The action will be based on the theory that the proceedings, if successful, would take $3,000,000 worth of taxable property off the rolls of that county.

ENTERPRISE, ORE.—Construction work utilizing the waters of the Wallowa river is to be started shortly by the Enterprise Electric Company. The first unit will develop 1500 hp. and developments up to 15,000 hp. can be made when occasion requires. It is expected that this will be the largest hydroelectric plant in this part of the state.

VALE, ORE.—J. Edwin Johnson of this place has applied to the state engineer for permit to appropriate 100 second feet of water from Malheur river for development of power for pumping, irrigation, municipal lighting and mechanical purposes. A dam is to be constructed and other work done. Total cost of the plant is estimated at $300,000.

PRINCE RUPERT, B. C.—Estimates of the engineer in regard to two hydroelectric projects, Thulme river and Shawatlans, were tabled at a recent session of the city council. First of these projects would cost $700,000 and the other $268,500. T. C. Duncan, the engineer, states that to make a detailed report on the two installations would cost another $20,000.

SEATTLE, WASH.—The city council of Seattle has passed, over the veto of the mayor, an ordinance increasing the city light and power rates twenty per cent. By the new ordinance the minimum monthly charge for lighting in residences will be raised from 50 to 75 cents and commercial light rates will be raised from 1 1-3 cents to 1 1-2 cents a kw-hr. as a minimum to 4½ and 5½ cents a kw-hr. as a maximum.

OREGON CITY, ORE.—A power plant that will develop 45,000 hp. is proposed in Clackamas county. Joseph R. Keep, 313 Couch Building, Portland, has filed application with State Engineer Percy A. Cupper for permit to appropriate 4000 second feet of water from the Sandy river and all its tributaries for power for general use. A large concrete dam will be constructed but the cost of developing the project has not yet been estimated.

SPOKANE, WASH.—It is reported that development of Z Canyon on the Pend Oreille river at Metaline Falls, one of the largest hydraulic projects in the West, is imminent. The water power rights at that point stand in the name of the Lead King Mines Company and it is anticipated that a visit will soon be made to the project by Hugh L. Cooper, international engineer, who in 1914 estimated the cost at $20,000,000 with a resulting production of 400,000 horsepower.

SEATTLE, WASH.—Figures have been received by the Board of Public Works for installation of a water power wheel and generator at Nehalem Creek and because of the special specifications covering the equipment were referred to Hydroelectric Engineer C. F. Uhden for examination and report. The figures received varied according to the weight of materials and other points, and range from $18,000 to $47,000 on water wheel and from $14,000 to $22,000 on the generator. Bids were received from Westinghouse Electric & Manufacturing Company; Allis-Chalmers Manufacturing Company; S. Morgan Smith; Pelton Water Wheel Company and Allen Cunningham of Seattle.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—With rates identical to those provided in their current contract, the Pacific Gas & Electric Company was awarded the contract by the city council for supplying the city with heat, light and power for the fiscal year 1920-1922. The bid as originally presented to the city council called for a rate of 85 cents per thousand cubic feet of gas, which exceeds by 10 cents the present rate. The company was permitted, however, to change its bid to 75 cents a thousand cubic feet. The contract calls for heat, light and power for all city departments and dredging operations.

REEDLEY, CAL.—Sealed bids will be received until July 6th for $4,5?5.98 bonds to pay the cost of an underground conduit system and installation of electroliers.

WILLOWS, CAL.—A petition is being circulated by Glenn-Colusa irrigation district calling for a bond election to be held in July for $2,587,000—interest 6 per cent.

REDWOOD CITY, CAL.—A deed has been filed transferring 7 acres of land on the marsh to the Beresford Country Club agents to secure a supply of water for the club grounds.

PLACERVILLE, CAL.—By a ratio of 5 to 1, Placerville has voted to issue bonds for the establishment of a municipal water supply. It is planned to purchase the present water works and to extend and improve the system.

SAN FRANCISCO, CAL.—A contract has been awarded by Architect C. B. Farlow, Holbrook Building, to Chadwick & Sykes, Crocker Building, for the erection of a one-story steel and concrete power house on the south side of Stevenson street, east of Second street, for the United Railroads.

SAN FRANCISCO, CAL.—The Sierra and San Francisco Power Company, which prior to the time it leased its properties to the Pacific Gas & Electric Company obtained from the Railroad Commission authority to issue $1,000,000 bonds, has filed an application asking leave to issue the bonds to the Pacific company. The delivery of the bonds is provided for in the lease.

SIERRA CITY, CAL.—Engineers are engaged in making surveys for a series of large storage dams in the North Yuba river, between Sierra City and Indian valley, the water to be utilized for power purposes. It is stated that the Yuba Development Company is behind the big project, and that it promises to develop into one of the large electric power schemes in California.

LEWISTON, CAL.—The Pacific Gas & Electric Company has taken over the power plant of the Trinity Dredging Company and will operate it under a short-term lease. The plant, which develops about 600 horsepower, has been idle for several years. It will be used to augment the power circuits of the Pacific Gas & Electric Company. About 30 men are at work preparing the plant for operation.

DELANO, CAL.—The capacity of the Delano water works is to be increased. The community uses 200,000 gallons a day, which is barely sufficient for consumers. To provide funds for the proposed new water equipment, the present minimum rate of $1.50 for 5,000 gallons will be raised to $2, with 10 cents for the next 1,000 gallons and 5 cents per 1,000 gallons thereafter. The new rate became effective July 1.

MODESTO, CAL.—Del Monte Properties Company, of which S. F. B. Morse is the president, is beginning construction of a concrete dam to store 750,000,000 gallons of water for irrigation of Los Laureles ranch to augment the water supply on the Monterey peninsula for domestic use and to water the new pleasure grounds and golf course planned by the company. According to Morse the water in the lake will meet domestic needs of the Monterey peninsula for 100 years and eventually supply Monterey, Carmel and Pacific Grove.

SAN FRANCISCO, CAL.—Inventory has begun of the property holdings, watersheds, reservoirs and distributing system of East Bay Water Company for submission to the mayors of Oakland, Berkeley, Alameda, Richmond and Emeryville, as the first step toward negotiation for joint municipal acquirement of the properties. The territory involved extends for 35 miles from San Leandro to Richmond. The purchase of facilities would give the municipalities sources for future development at Cull and Crow creeks of 11,000,000 gallons.

WILLOWS, CAL.—The threatened power shortage has begun to materialize. Within the past few days, due to low voltage, many motors have been burned out, and the power reduced to such an extent that the pumps fail to throw the necessary amount of water. The officials of the power company state that they are already running their steam plants to full capacity, in addition to the regular water-driven generators. These steam plants furnish about 112,000 hp. The peak of the power load has not yet been reached, as it is expected that the requirements during July and August will be much more than at present.

MODESTO, CAL.—The board of directors of the Modesto Irrigation District visited San Francisco recently for the purpose of interviewing John A. Britton, general manager of the Sierra Power Company, the state bonding commission and city officials. An agreement was made with San Francisco for the crossing of the Don Pedro site with the pipes that are to convey the water from Hetch-Hetchy to San Francisco. Three projects were presented to the Sierra Power Company for the power they seek. One plan is for the irrigation district to buy out the right of way, a second is for the irrigation district to supply a certain amount of power to the company to be allowed water to make their own power as they now do.

SAN FRANCISCO, CAL.—The Blankenhorn-Hunter-Dulin Company and the Anglo-London & Paris National Bank are offering an issue of $750,000 James Irrigation District (Fresno county) 6 per cent Serial Gold Bonds, due January 1, 1928 to 1942 inclusive. The James Irrigation District is comprised of 26,648 productive acres, located 24 miles southwest of the city of Fresno. The actual value of the net acreage within this district is appraised at $3,916,155, or $150 per acre. These bonds are a legal investment in California for savings banks, commercial banks, trust companies, trust funds, insurance companies, school funds, and are valuable to secure public deposits. They are totally tax exempt in California and exempt from the federal income tax, and are being offered at prices to yield 6.20 per cent.

THE PACIFIC SOUTHWEST

RIVERSIDE, CAL.—The Southern Sierras Power Company is planning to construct a water softening plant soon at its San Bernardino plant to cost $20,000.

BREA, CAL.—A special election will be held August 3 for the purpose of voting on a bond issue for $75,000, for the construction of a municipal water system.

LOS ANGELES, CAL.—Bonds will soon be voted on for the installation of a proposed ornamental post lighting system in Hollywood. The estimated cost is $30,000.

PASADENA, CAL.—Ten thousand feet of new mains will be laid this summer in Pasadena and Altadena by the Los Angeles Gas & Electric Corporation. Work is to start at once.

LOS ANGELES, CAL.—Plans of the Southern California Edison Company for future development, include the expenditure of a million dollars every month for the next ten years.

SAN BERNARDINO, CAL.—Third Street will be lighted from Arrowhead to Mt. Vernon Avenue, with new reinforced concrete posts with three lights each. Bonds will be voted to cover the cost of construction.

WINSLOW, ARIZ.—Ordinance No. 93 provides for a special election to be held July 24th, for the purpose of voting on a bond issue for $39,000 to be used for the purpose of purchasing a gas plant and equipment.

LANCASTER, CAL.—No bids were received for bonds issued for the construction of the water works district at Lancaster. It is planned to form a syndicate among large land owners and purchase bonds at par and distribute to subscribers to the fund.

EL CENTRO, CAL.—Plans of Engineers Chester Allison and Francis Sollow to build an immense storage reservoir at Volcano Lake to force the Colorado River back into its old channel will soon be made public, at a meeting of the Imperial Valley Bankers' Association.

BRAWLEY, CAL.—A municipally owned electric power plant for Brawley at a bond issue cost of $200,000 is proposed and will come before the council at its next meeting. The proposition embodies construction of a dam across the Alamo river at Alamorio. The plant itself is to be constructed in three units of 150 kw. each.

THE INTER-MOUNTAIN DISTRICT

FLORENCE, IDA.—An electric light and power plant is being installed here.

GREAT FALLS, MONT.—A resolution has been passed by the city council providing for a lighting system on First Avenue, South, to cost about $25,000.

MISSOULA, MONT.—According to Mayor John P. Swee, a preliminary power permit has been granted this place for the development of electricity for heat, light and power.

DUBOIS, IDA.—The village board at its regular session on June 17th fixed a minimum power rate of $7.50 per month. This covers the expense of installing transformers by the city.

HUNTINGTON, UTAH.—Extensive improvements are being made in Huntington, one of the most important of which is extension of the street lighting district, to cover the entire town.

EPHRAIM, UTAH.—For the second time in ten years the city electric light plant has been run for some time on the water from Maple Creek run. At the present time the city is unable to use more than half of the water in Maple Creek.

TOOELE, UTAH.—Work is to start at once on the 1000-ton concentrator which the Utah Consolidated Mining Company is to erect here. This new plant will take care of low-grade ores. The mill will be operated by electric power.

NEPHI, UTAH.—Nephi City, through its mayor, has applied to the Public Utilities Commission of Utah for permission to increase its rates for electric energy for lighting and power. The present rates and the increases asked are not given in the petition.

HELENA, MONT.—Application has been filed with the registrar of public lands by the Rocky Mountain Company of Butte for a permit to develop water power on the Flathead river. The proposed development would involve construction of five dams with an expenditure of from $5,000,000 to $10,000,000.

CALDWELL, IDA.—Final conclusion has been reached in the matter of settlement of purchase of the McNeil branch of Caldwell Traction Co. by farmers and business men. J. B. Franklin, Boise engineer, recently inventoried the property, estimating its value at $60,000. He also made an estimate of the cost of building a line to Pickle Butte Bridge, about 2 miles, three-fourths of a mile being already graded.

MISSOULA, MONT.—Papers have been received here from Helena granting permission to form a corporation for the development of a power plant on Rock Creek. The new company will be incorporated for $500,000, a majority of this amount to be spent in the erection of a large hydroelectric power plant at the mouth of Rock Creek, east of Clinton. It is the intention of the new company to erect a plant that will generate about 20,000 horsepower, the greater part of which will be used for irrigation purposes.

MILFORD, UTAH.—The town of Milford, a municipal organization, has filed a complaint with the Public Utilities Commission of Utah, declaring that the Telluride Power Company, which has been furnishing the town with electric energy to pump water for the municipal water plant, has more than doubled the rate which had been paid prior to the first day of the current year, and has presented bills which the town trustees declare to be excessive. The municipality demands a hearing and that the old rate remain in force.

GRANGEVILLE, IDA.—A considerable sum of money will be spent by the Grangeville Electric Light & Power Company in enlarging its plant at the mouth of Lolo Creek and the voltage of all the company's lines will be increased from 6600 volts to 23,000 volts. This is to be brought about by raising the dam at Lolo Creek where a new water wheel will be installed. Other improvements include a new pipe line and new generator. These improvements were made necessary by great increase in company business, particularly at Orofino, Idaho.

BOISE, IDA.—Cómplaints from Lewiston have been received by the public utilities commission of Idaho alleging that the Washington-Idaho Light & Power Company is dismantling its steam plant across the river in Washington. This plant enables the company to supply standard service during the time when the stream which usually supplies the power is frozen up, or the water plant otherwise crippled. Lewiston citizens fear the menace of fire with no reliable power for pumping, and the railway there also depends upon the system for power.

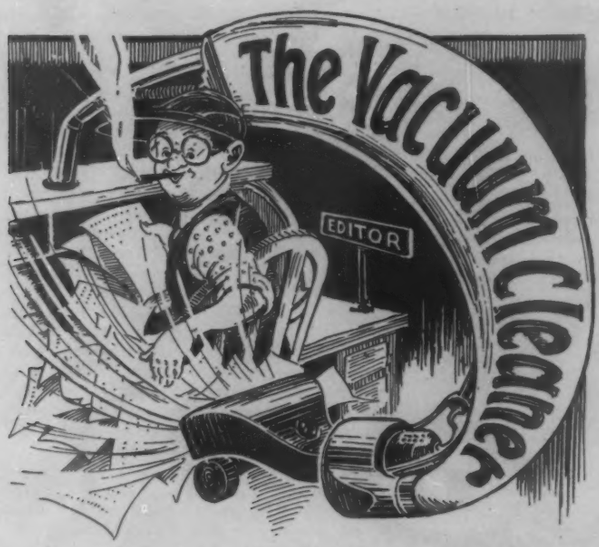
SALT LAKE CITY, UTAH.—The Bamberger Electric Railroad Company has filed a petition with the Public Utilities Commission of Utah, requesting an increase of 100 per cent in rates charged for the transportation of milk and cream. This company operates a special milk train between Salt Lake City and Ogden, and it is claimed that this milk train is operated at a loss at the present time, due to the large decrease in milk traffic. This decrease is caused by the fact that most shippers are now using trucks, except when weather conditions are bad.

MISSOULA, MONT.—A preliminary power permit has been granted the town of Ronan by the department of the interior, for the purpose of developing electricity for heat, light and power, in Crow Creek canyon, four and a half miles northeast of that city. Work on the plant will be started in the near future. Under the permit development will have to be made within the next 12 months. This will make possible the furnishing of electricity to other towns on the reservation other than Ronan. A new system of street lighting has been installed and was put into operation about July 1.

LOVELAND, COLO.—Right of the city of Loveland to bring condemnation proceedings to secure the distribution system of the Western Light and Power Company within the city, in connection with the municipal electric plant, has been upheld in the district court at Fort Collins. The court overruled the power company's demurrer to the petition to condemn and sustained the city on eight out of nine contentions. This means that the condemnation suit must go to trial on its merits. The company was granted fifteen days in which to plead. It is not expected that the condemnation suit will come to trial before the September term of court.

KAMAS, UTAH.—The public utilities commission of Utah has issued an order, in the application of the Kamas Light, Heat and Power Company, in which the public utilities commission retains jurisdiction of the case. The petition was for permission to increase rates. The commission grants an increase, but will closely watch the result of operations under the rates prescribed and will, if it is found necessary or advisable, modify its order to meet conditions existing later. The new rates for lighting are as follows: Minimum per month, $2.00; residential and commercial lighting, 15c per kw-hr.; Kamas high school, minimum charge $4.00, meter charge $10.00; connection charge, $3.50.

BOISE, IDA.—The Idaho Power Company has filed a petition for a rehearing in the application of that company for the approval of an increase in irrigation rates. The Idaho Power Company petitioned for an increase of 60 per cent in its irrigation rates, and on June 2 was allowed an increase of 10 per cent. The company's petition is made on the grounds that: "The said decision of the public utilities commission is against the evidence. That, while clearly recognizing the inadequacy, unreasonableness and injustice of the irrigation rates sought to be superseded, and while further recognizing the necessity, reasonableness and justice of the increased rates, the order fails to put into practical effect this recognition by any substantial increase in irrigation rates."



Watt's in a name? as our facetious electrical friends continue to remark on all possible occasions. We have just heard a story of a well-known lawyer of Chicago, who made an application to register a trade-mark for "Limestone-Brand," which was denied by the Examiner of Trade-marks on the ground that the medicine contained limestone. He wrote back saying it contained none, then they said it was deceptive. So he prepared a brief on the subject, which included the following statements:

"Ivory is a good trade-mark for soap not made of ivory. Gold Dust Washing Powder is not made of gold. Old Crow Whisky is not distilled from crows. There is no bull in Bull Durham. Royal Baking Powder is not used exclusively by royalty, nor is Cream Baking Bowder made of cream. Pearline contains no pearls, and White Rock is water.

"There is no cream in cream of tartar, in cold cream or in chocolate creams, no milk in milk of magnesia, in milkweed or in the cocoanut. These are all as remote from the cow as the cowslip.

"There is no grape in grapefruit or bread in breadfruit. A pine apple is neither pine nor apple; a prickly pear is not a pear; an alligator pear is neither a pear nor an alligator, and a sugar plum is not a plum.

"Apple butter is not butter. All the butter is taken out of buttermilk, and there is none in butternuts, or in buttercups, and the flies in the dairy are not butterflies.

"Peanuts are not peas, and it is doubtful if they are nuts. Sailors wear pea-jackets—peas do not, they have peascods, which, by the way, are not fish."

We might add also that a horsepower does not eat oats, a knife switch is no good for cutting bread, a foot-candle is not a device used by chiropodists, and insulator pins are worthless for dressmakers.

* * *

Collectors of the series known as "Foolish Question number 997" will welcome the following:

The commuter reached the station platform just as the 5:15 was pulling out. A little burst of speed before the admiring onlookers netted him fifty feet in overcoming the train's handicap but it was a losing race. He quit at the end of the freight yard and returned.

"Miss your train, sir?" inquired the porter cheerfully.

"Oh, no, I was just chasing it out of the yard."

Illumination is a growing science, and apparently a very subtle art. We quote the following from the abstract of an address on illumination:

"In regard to pulpit lighting he suggested that neither the lamps nor the inside of the reflectors to be exposed to view, that the preacher's face to be about 4 foot-candles, so that every expression is observable, that the reflectors to be well clear of the preacher's head but not too far for economy of lighting, and that the switch for the desk lamp be arranged to be operated from the pulpit."

We notice no mention is made of the location of the switch for the reflectors, but if these too are operated from the pulpit there may come to be new meaning in descriptions of this kind: "The torrent of his words bore him along; his expression became rapt and a great light seemed to illumine his countenance."

* * *

Fish stories and golf stories are familiar enough in the electrical industry but golf strokes and fish have nothing on some industrial plants. The following is quoted verbatim:

"The climate in this locality is very extreme. It is said that the gas went off in the cook house one day, and the cook, whom one would think to be quite worried over the matter, calmly moved the stove out in the sun. That afternoon the wind changed to the north and a steam pipe froze between the boiler and the pressure gauge. The formation of the ice caused the pressure gauge to rise. When it reached 130 pounds the safety valve was supposed to blow, and while the fireman was cutting off the fire and turning on the feed water the pressure had reached 150 pounds. The fireman next blocked the safety valve open and the gauge showed 180 pounds. By that time every one had left and was standing around at a very safe distance, waiting for the expected explosion. Finally one of the braver men went back into the boiler room and discovered 200 pounds pressure on the gauge and none in the boiler."

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In the news columns of a daily paper we note a reference to a "stalled capacity of 10,000 horsepower." A singularly well-stocked stable for these days of automobiles.

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It has always been difficult to get the aesthetic and the scientific to see things the same way. Look what happens when the artist hears the engineer mention a "worm-driven drum."